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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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MR. E. G. COWDERY, General Manager of the Milwaukee (Wis.) Gas Light Company, has been appointed General Manager of the Laclede Gas Light Company, of St. Louis. His successor at Milwaukee will be Mr. E. G. Pratt, of Des Moines, Ia.

[OFFICIAL NOTICE.]

Nineteenth Annual Meeting, Ohio Gas Light Association.

OHIO GAS LIGHT ASSOCIATION,
OFFICE OF THE SECRETARY,
DELAWARE, O., Feb. 20, 1903.

The Nineteenth Annual Meeting of the Ohio Gas Light Association will be held at Cincinnati, O., March 18th, 19th and 20th, 1903.

The President, Mr. C. W. Andrews, of Hamilton, O., will call the meeting to order on Wednesday, March 18th, at 9:30 A.M., in convention hall at the Grand Hotel, the headquarters.

The Executive Committee have again made a radical departure in their programme, in that a Question Box Editor has been appointed, in the person of Mr. Henry L. Doherty. Written questions have been asked and answers returned, and this department will undoubtedly be one of the most interesting features of the meeting.

The following papers will be presented:

"Domestic Heating by Gas," by Mr. Donald McDonald, Louisville, Ky.

"Natural Gas as a Factor in the Artificial Business," by Mr. F. W. Stone, Ashtabula, O.

"Construction and Operation of Gas Benches," by Mr. W. A. Baehr, Denver, Col.

"Progress Department," edited by Mr. Irvin Butterworth, Denver, Col.

"Wrinkle Department," edited by Mr. E. E. Eysenbach, St. Paul, Minn.

"Novelty Advertising Department," edited by Mr. B. W. Perkins, South Bend, Ind.

An opportunity will be given any of the speakers at the meeting to correct their remarks before leaving Cincinnati, but not after, as all reports will be turned over to the printer immediately after the adjournment of the meeting.

On Wednesday evening, March 18th, the Association will be the guests of the Cincinnati Gas and Electric Company at a theater. On Thursday, March 19th, the Convention will be the guests of the Hamilton-Otto Coke Oven Company. A special train will leave Cincinnati, at 12:20, on a trip to inspect the coke ovens at Hamilton. The members will be entertained at luncheon at the F. & L. Kahn & Bros. new stove factory. Returning from Hamilton the train will arrive in Cincinnati about 6 o'clock. In the evening the Association will be the guests of the Stacey Manufacturing Company and the United States Cast Iron Pipe and Foundry Company at dinner.

The Grand is conducted on the American and European plans, and the following rates have been secured for the meeting: American plan—$3 to $10 a day. European plan—$1.50 to $7 a day. The Grand hopes to entertain all of the Association, and will put forth every effort to make the members comfortable. The most satisfactory quarters are always obtained by writing in advance to the hotel people.

Through the courtesy of the lines constituting the Central Passenger Association, persons attending the meeting will be granted special rates for transportation under the certificate plan; viz., full fare going,

LIBRARY OF MAR 16 1903 SMITHSONIAN DEPOSIT.

and one-third fare returning by the same route. Be sure to obtain a railroad certificate when buying your ticket for Cincinnati.

The Secretary will furnish application blanks for membership, and any further information which may be desired relative to the meeting.

T. C. Jones, Secretary.

[Official Notice.]

Wrinkle Department, Western Gas Association.

Western Gas Association,
Office of the Wrinkle Department,
721 Citizens Building, Cleveland, O.

To the Members of the Western Gas Association: The Wrinkle Department is now ready to receive contributions for the 1903 collection, and I would thank you to please send a sketch or description of any new device or method you may have to the above address.

Any sketch, photograph or drawing, accompanied by a written explanation, of a new idea will be gratefully received, and it is hoped that you will comply promptly by favoring us with a contribution.

Respectfully, W. E. Steinwedell,
Editor Wrinkle Department.

BRIEFLY TOLD.

Death of Mr. Hugh Harbison.—With great regret we are obliged to chronicle the death of Mr. Hugh Harbison, of Hartford, Conn., who passed away, at his home in Hartford, the morning of the 11th inst. Deceased, who was in his 70th year, having been born October 26, 1833, resided in Hartford since August 26, 1849, and was the senior Director in the Hartford City Gas Light Company, having served on the Board since 1864. The funeral services were held at his late residence, the afternoon of last Thursday, the celebrant being Rev. Dr. E. P. Parker, of the South Church. In due time we will print some record of his long, honorable and useful life.

The Status of the Isbell-Porter Company.—We have received many inquiries respecting the actual status of the Isbell Porter Company, whose long and honorable record in the engineering and founding business of this country has made the name a well-liked one amongst the gas men. That a general reply may be made to the queries the following authoritative statement is printed. Owing to the temporary inability of the Company's largest debtor to meet certain of its notes as they fell due, which notes had been sold in the usual way by the Isbell-Porter Company, and which failure caused the latter to postpone certain obligations maturing, an application was made for the appointment of temporary receivers, in the U. S. Circuit Court for the Southern District of New York. The proceedings were taken without any active dissent on the part of the Company, whose proprietors are satisfied that the action is in the welfare of their creditors and customers in general in safeguarding the interests of all. Judge Lacombe, on the 2d inst., appointed Messrs. R. K. Wehner and John J. Townsend temporary receivers. The former has been Treasurer of the Company for years, and is thoroughly conversant with the details of its trading. In addition to large cash payments due the Company and about to become due, it has upon its books a very valuable schedule of contracts which the receivers, under the direction of the court, will proceed to execute, and the outlook sustains the view that very soon the Company will be able to pay every creditor in full and resume business under the old-time conditions.

Death of Mr. E. S. T. Kennedy.—Mr. E. S. T. Kennedy, son of the late Mr. John P. Kennedy—the latter was probably best known in the gas industry from his membership in the founding and engineering firm of Hoy, Kennedy & Co., and from his long and active connection with the Mutual Gas Light Company, of the city of New York—died at his home in Rutherford, N. J., the morning of the 10th inst. Deceased at one time was active as a gas engineering constructor, and for many years had been prominently identified with the fortunes of the Hazelton Boiler Company.

An Acknowledgment.—Messrs. Adam Weber Sons, of this city, writing to the Journal under date of the 11th inst., say: "We beg to acknowledge the error in our advertisement regarding the erection of 20-foot retorts and benches of 9's. Mr. George G. Ramsdell's statements are correct, and we apologize for the mistake."

[Official Report—Revised by the Secretary.—Continued from Page 366]

THIRTY-THIRD ANNUAL MEETING OF THE NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

Held in Young's Hotel, Boston, Mass., Feb. 18 and 19, 1903.

First Day, Feb. 18—Morning Session.

Discussion on the paper,[1] *by Mr. S. E. Baker, of Fall River, Mass., on "Methods of Bill Collecting."*

The President—Gentlemen, you have heard a capital paper that gives a first rate working schedule. Certainly a great many members must want to add to the ideas that Mr. Baker sets forth.

Mr. Sherman—I would like to ask Mr. Baker to what extent, if any, his Company has adopted prepayment meters.

Mr. Baker—We have a few, about 275 in use; not very many in proportion to our whole number of meters.

The President—Mr. Jenks, have you not a different practice, although in the same neighborhood?

Mr. Jenks—I cannot say we have quite as complete a system as that. We have about the same class of population as that in Fall River. We have a deposit system that we carry out rather religiously. This paper of Mr. Baker's, however, has set me thinking, and I believe it will result in the revising of our system to some extent.

The President—I have heard a number of gentlemen say that since this paper has been published they have begun to use a good many of the ideas that have been advanced. Mr. Barnes, cannot you add to the number?

Mr. Barnes—The system which the paper outlines is very much like the one we are using in Cambridge at the present time, but we are more stringent on the matter of deposits than they are in Fall River. We require from entire strangers a deposit, or else a satisfactory guarantee from the owner of the property, or from some consumer whom we have known for a long time, unless a man should come to us with a satisfactory recommendation. We don't find it easy to ascertain the man's standing, where we have 16,000 consumers, and people are coming in everyday for new meters. It is not always easy to look them up and give them satisfactory service, and give them the meter as soon as they want to begin to use it, so we find it better to adopt the system of deposits and guarantees or strong recommendation. The method of collecting is very much the same there as it is in Fall River. I should like to ask the gentleman from Fall River if he can give us in an approximate way the results of this system; tell us what percentage of his bills rendered are uncollected?

The President—Perhaps Mr. Baker will answer that.

Mr. Baker—In 1901 we charged off of our total sales .48 of 1 per cent. That was the loss. In 1902 we reduced that to .39 of 1 per cent. That is what we charged off, and we charged it off quite religiously. In 1901, of that .48 of 1 per cent. we collected $82.24. Roughly speaking, we charged off, in 1901, to make it a little clearer, probably about $1,000, and in 1902 about $800. In 1901 we collected $82.24, and in 1902 we collected $208.69, with hopes of more to come. The other day I collected a bill 2 years old.

The President—You have heard how the seaport town accomplishes its good work. Will Mr. Woodward tell us how the mountains get along?

Mr. Woodward—We have listened to a most interesting paper, and one we would all like to have on file, but the thought occurred to me that what is applicable in Mr. Baker's case to a large company may not be so applicable to a small one. His system is good, and most systems are good. Method is what we want in our business. What he carries out through a printed record we largely carry out through the ability of the cashier, who has those points in her or his head. The cashier would be expected to know all the customers in a small company, and not only to know them by name but to know a little about their business, and of their ability to pay. The value of a good cashier or office man lies in just that knowledge, and that is one of the chief, if not the most important, positions that we have in an office. It has always been our experience that it was very valuable have a lady in an office. "An over zealous credit man, by clinging too closely to his written record and not allowing his judgment fair play, would be apt, in a company where shutoff notices are frequently sent, to be a brake on the wheel of the new business department." That is a point that needs thought. Don't we put brakes on our new business department? We are often called "robbers" and "grasping monopolies," and we become a

1. *Ante*, p. 364.

bit hardened to it. By insisting on payments and ramming shutoff notices down our customers' throats do we not open ourselves to some just criticism? The consumers often complain about their bills, but you should bear in mind that they have to pay for something that they don't see. They get the result from the gas, but they don't see the article itself. It is something that they neither taste nor see nor handle. They generally have little confidence in the meter, and often think the gas company is imposing on them. A long standing prejudice exists against gas companies, dating way back to the time when they could tell them they could take it or leave it, as they saw fit. Times are different now and we are trying to overcome these prejudices. There is a difference indeed between the dead beat and the unfortunate and temporarily embarrassed. Another point. The canvasser should not be asked to do collecting. The prime requisites of a canvasser are affability and power to make friends and to make sales. The collector is expected to bring the money in. He may possibly make some enemies. It never seemed to me that the two positions, those of canvasser and collector, should be embodied in the same person. It is by such little notices as, "We will call to-morrow for our money," that we may make ourselves perhaps a little unpopular. Let customers run over a bit on their agreed terms of payment. If they are not dead beats you will not lose anything by it. No company here loses more than 3 per cent. as the aggregate of all its uncollectable bills, and most of them not 1 per cent. Is this 1 per cent. worth such tremendous effort to collect, at the expense of giving your company a bad name or of being called grasping? In the sale of ranges we take a lease-contract, and it is a constant surprise to us to see how well those contracts, without any dunning whatever, are lived up to. In the collecting of gas bills most companies give a discount for prompt payment, and this is right and fair. The discount collects the bill. It is a good point in favor of a manager that he collects his bills closely, but he ought to do it with just as little friction as possible. The price at which the company sells its product makes little difference with the number of complaints. The "kicks" come in just as often and just as hard on gas at 75 cents a 1,000 as they do at $3. I wish only to emphasize, in closing, that we guard against too rigorous attention to collections and thus put a brake on the new business department, and also cause our companies to become more unpopular with the people.

The President—In connection with this paper we might as well consider two of the questions, which are as follows:

> "In the use of prepayment meters, what methods are adopted for comparing the returns of the money boxes with the actual registration of the meter?"

Also:

> "How can the gas consumer be induced to read his own meter? If he would do this, would it not reduce the complaints of 'big bills!'"

I should like to have "Big Bill" McGregor tell us about that.

Mr. McGregor—We have a card system on the prepayment. The collector takes the cards out. He puts down exactly what the reading of the meter is, and also places in another column the amount of money he takes out. At the office the showing on the card is copied on a book. Of course, the cash is over the amount registered by the meter. I don't know that any other way can be taken to get it. It is sometimes unsatisfactory not to know exactly where you stand on the matter; but we have had no losses, demonstrating that the collectors we have are honest and that the meter is carefully registering all gas that goes through.

The President—With respect to the reading of the meter, has the education of consumers been generally undertaken? Mr. Nettleton, will you tell us the practice in New Haven?

Mr. Nettleton—So far as trying to educate consumers in reading meters is concerned, we are doing very little unless a person shows an interest. It seemed to me it was almost impossible to get the average consumer to take sufficient interest in the matter to learn how, or if he knows how to read the meter he will rarely take the trouble to do so. In the matter of prepayment meters, however, we are following, perhaps, a different line from Mr. McGregor, and possibly it may be new to many of the members. I think the scheme was gotten up in Buffalo. A meter index book is made with loose leaves, one leaf for each consumer. Each leaf is printed in squares, with the months of the year printed, one month to each square. On the month, when the collection is made, the statement of the meter and the amount of money are entered. When the collector comes in at night he adds up, or it is added for him on an adding machine, the amount of money that he should have; he balances his cash and turns it over to the cashier. The statement books are turned into the book-keeping department, where the statement is entered on the ledger, and if there is an over or a short it is noted. If it is either way to any amount, a difference of, say, a dollar, the meter is taken out. When the man goes out the next month with the statement book he has absolutely nothing to guide him, unless he shall have made a memorandum on a private book of his own. He simply goes to that meter as an absolutely fresh meter and sets down the statement. While I am on my feet, Mr. President, I would like to call attention to a matter that was brought up here some years ago by Mr. Woodward, in regard to collecting past due bills by means of the prepayment meter and charging a higher price. At that time I think it was objected to by many members of this Association. I am now trying it in New Haven in quite a large way. The meters that are used for this purpose are painted blue, so that the collection meters are known to the men simply by the color alone. A person owes us a large bill, or a bill of any amount. He is unable to pay it. He wants to use gas. He would consider it an arbitrary act if we said he could not have gas. He is honest, but he cannot pay. We suggest to him that he use the blue prepayment, which is fixed to pay for gas at the rate of $2 per 1,000, $1 of which pays for the gas and $1 applies to his old account. If he assents to it he then signs a statement, stating the facts, that he owes us so much money and he wishes to pay it in this way. It has worked admirably. We have had out for several months about 130 of those meters, and 2 months ago they had collected for us on old accounts over $1,100. The "blue" meter has been in use now for about 15 months, and not a hitch has been found in it, so far as I know. I believe in that system of collecting. They are small payments; very small indeed; a quarter at a time on the old bill; but unless the meter is robbed the company gets it.

The President—Will any other member contribute his experience?

Mr. Coffin—Mr. President, we have adopted a system of pre-payment meters. When our man goes to read the meter he takes it on the nearest even number (as we sell 200 feet for a quarter), and he then takes out of the box money enough to cover that reading, so that an overplus is always in the meter. Then the book and the money returned tally. Speaking of this collection, we found last year very much to our surprise that our collections were over 100 per cent. We had collected enough in lost discounts to pay the charged off bills and .7 of 1 per cent. over.

Mr. Crafts—I would like to ask Mr. Nettleton whether the blue meter was put in with the full knowledge of the people as to what it was for.

Mr. Nettleton—Yes; they sign a request asking the company to set the meter, in order to pay a bill which they owe the company of —— dollars. The request states that the meter is adjusted to use gas at the rate of $2 per 1,000, and $1 of this shall apply on the old bill. It is done with the full knowledge of the people. Otherwise there would be trouble, of course.

Mr. Crafts—In connection with bill collection, I think the difficulty with most companies is the collection of the small accounts; that is, what we call the material accounts. In our experience a good many small items for mantles, chimneys and tubing were difficult to get in. We would send in the bill at the end of the month, and there would be a good deal of friction over it. To help that we make a charge slip in duplicate, which is made practically in the form of a bill. One of them is left with the consumer—it is left personally with him if possible. We find that in perhaps 50 per cent. of the cases the people then and there pay that small bill, and we have no charge to make of it. In that way we have materially reduced the number of accounts of small items.

Mr. Fowler—Will Mr. Nettleton have any objection to printing that form of application for blue meters?

Mr. Nettleton—Not at all.

Mr. Fowler—I would suggest, then, that it be printed with this discussion. It will undoubtedly be interesting to many of the members.

REPRINT OF THE NEW HAVEN BLUE METER FORM.

New Haven, Conn.....190

TO THE NEW HAVEN GAS LIGHT CO.:

Gentlemen—I am indebted to you for gas supplied in the sum of..... .....$\frac{}{100}$ Dollars ($), ... which I desire to pay, and for the purpose of doing so, I hereby authorize you to place for me at No .....a prepayment gas meter regulated to supply gas at the rate of 125 feet for each 25 cent piece, or $2.00 per 1,000 feet, with the understanding that one-half of the amount so paid by me shall apply on my indebtedness to the Gas Light Company above stated; and that as soon as said indebtedness is extinguished, then the meter shall be removed, and another meter shall be set, and thereafter I shall be charged the regular price for gas.

Approved:

....., Signed..... .....

Is it residence or business place?.....
How long at place applying for? .....
Where before?.....
How long there?.....
Where before that?.....
.....
How does name appear in directory?.....
Business or occupation?.....
Business address?.....
Remarks?.....

Mr. Woodward—I would ask Mr. Coffin his idea of leaving any money in the box. I should think you would rather have that surplus brought to the office. Most companies would rather get those collections in as soon as possible as a matter of safety, and often companies collect more than once a month in order not to leave money in the boxes any longer than they can help.

Mr. Coffin—Our folks don't put in large amounts. It is very rare that we leave more than one or two quarters there. It really struck me as though it was easier to take care of it the other way, to have one balance the other, than to be always carrying forward more money than the account called for. We have had but one box robbed, and we notified the parties that we should hold them responsible for it and moved the meter.

The President—Has there been any extensive use of dummies instead of coin in any of the cities represented?

Mr. Cooper—Mr. Barnes spoke about each company requiring a deposit. I would like to ask him, if the fact of having a prepayment meter to furnish a consumer did not bridge over the trouble of having to ask for a deposit in cash.

Mr. Barnes—Mr. President, I did not intend my remarks in regard to deposit to apply to prepayment meters. We don't require any deposit on prepayment meters. We require an obligation that, in case the box is robbed, the consumer shall be responsible for the contents of the box. They sign an application agreeing to be responsible for the contents of box until the contents have been removed or the meter removed by the company. I have a very vivid recollection, Mr. President, that last year our friend from New Haven endeavored to throw every possible protection around his employees in the matter of honesty, and he had a good many very excellent safeguards in that respect. I would like to ask him if he has any safeguard now to prevent a collector going about among these prepayment meters and reporting a less amount of cash than he actually takes out; whether that might not go on under his system for one or even two years, and the collector in that way be able to pocket quite a large amount?

Mr. Nettleton—I think, Mr. President, I did not make myself very clear, otherwise Mr. Barnes would have seen that the system does cover that very point. The statements of the meters, not only the money but the reading, are handed in. Those are compared by the ledger clerk with the previous statements and with the money. When there is an over or a shortage amounting to $1, the meter is taken out, and we try to find out what the trouble is. Now, by changing the routes of the collectors occasionally, once in 3 to 6 months, all liability of losing in that way is done away with, if there is any risk at all.

Mr. Barnes—I think I understand the gentleman's system perfectly; but I would like to ask him what would prevent a collector going out to-day, for instance, and finding, as we find sometimes in our boxes, anywhere from $8 to $10, taking $10 out of the box, putting down the state of the meter 5,000 feet less than it actually is, and putting the other $5 in his pocket?

Mr. Nettleton—Then he must keep a private memorandum of the matter, because when he goes round the next time if he sets down the real state it will immediately show a shortage.

Mr. Barnes—That he could do, could he not, under your system?

Mr. Nettleton—He could do it; but what would happen when we changed the route?

Mr. Barnes—Then he would be detected. Do I understand that you make it a rule to change your routes periodically?

Mr. Nettleton—We make it a rule to change the routes, but not at any specific time.

Mr. Barnes—So that that man never knows which route he is going out on?

Mr. Nettleton—He assumes that he is going out on the old route until a change is made. He follows the same route for—well, 2, 4, 6 months. For a short time the company can lose money.

Mr. Barnes—How often do you collect the prepayment meters?

Mr. Nettleton—Generally once a month, but where there is a large amount, or where they are exposed to danger, once in two weeks, and I think there are a few once a week, but they are very few.

Mr. Barnes—We have only a small number of prepayment meters out; I think at the present time something between 350 and 400. Up to the present time our system has been this: We send a collector to the prepayment meter twice a month, and in connection with the regular reading of the other meters those prepayment meters are read by the regular meter reader, who has nothing to do with the collecting. The meter card is tied in for a prepayment meter just the same as it would be for a regular meter, and that becomes a part of the regular meter reader's route. He goes to the house and puts down on his card the reading on that day of the prepayment meter. That is compared in the office with the return sent in by the collector. I don't know whether that is a sufficient safeguard to warrant the extra trouble in a place where they would have as large a number of prepayment meters out as I understand they have in New Haven; but it seems to me an excellent safeguard for a moderate number of prepayment meters, such as we have in Cambridge.

Mr. C. A. Learned—Mr. Barnes and Mr. Nettleton have struck a very important point. In Meriden we have something like 1,200 prepay meters. Two-fifths of all of our meters are prepay, and about one-fifth of all the gas that we make passes through them. A few days since the auditors, in looking over our books found that there had passed through prepay meters something over 12 million feet, and for that we had obtained something over $16,000. The question arose at that time what check we had upon the meter indexers. They were told that we had 6 very reliable young men who took the prepay indexes monthly at the same time that they took the regular meters. One of the directors a short time since happened to come into the office when a number of hundred dollars in quarters were lying upon the table. He asked the manager what check he had upon the prepay system, how he knew that the index was taken correctly and that the collector did not put some of the money in his pocket and give an incorrect index. It was so important that it was then decided that one of our young men should pass around once in 6 months and read all of our prepay indexes, taking no money, so that that reading could be compared with the index taken by the regular meter taker and we could see if it was correct. The change of routes was thought unadvisable, because that would run into a great deal more expense than having a young man go around once in 6 months to check up the indexes.

The Secretary—I would like to inquire if any, or how many, are charging more for their gas in the prepayment meters—that is, leaving out the question of blue meters—than their regular rates.

The President—Will those who do so please raise their hands? [One hand was raised.] Those who charge a larger price for gas bought through a prepayment meter will please raise their hands. [Two members raised their hands.]

Mr Coffin—I would say that the difference comes in figuring out the amount of gas to sell for a quarter. We sell our gas regularly for $1.20, which is 12 cents per 100. We will sell 200 feet for a quarter, which is at the rate of 5 cents per 1,000 more than the regular price, but it is the nearest I could get it.

Mr. Woodward—That is the only qualification I wish to make. Our rate is $1.35 net. We ought to give our consumers 186 feet for a quarter, but we set our meters at 180 feet, so that they do not get quite as much gas as they are entitled to; but that cannot be obviated.

The Secretary—Then I understand from this expression that the general practice is to get nothing for the increased capital cost of setting the prepayment meter, except in freedom from worry, from bad debts and deposits. I would also like to inquire about the setting of prepayment meters in the same kind of places that you would set ordinary meters. The question of the protection of the prepayment meter has always been enlarged upon. The question has come up in my mind whether the risk is not smaller than has sometimes appeared, whether if the consumer were held responsible for the safety of the meter, for the gas as registered by the meter and the money box, the liability to loss by theft would not be practically so small that we could neglect it.

The President—I think an answer can be given to Mr. Gifford's question. Those who have suffered a permanent loss by theft from prepayment meters I will ask to raise their hands.

Mr. Woodward—What do you mean by a permanent loss?

The President—A loss not made good by the person for whom the meter was installed. [Four hands were raised.]

The President—Will those who have not endured a permanent loss raise their hands? [Several hands were raised.]

The President—About an even matter. Is there any other gentleman who wishes to speak on this subject?

Mr. Scranton—In Derby we have about 2,259 prepay meters, which is over 50 per cent. of the meters we have out. We are setting those meters in the same places in which we originally set our common meters. Most of our meters are set in the cellar, near the riser. We don't make any distinction if a customer applies for a meter; if it is in the hallway we put it in and take our chances. We have averaged, I should say, about one a month, in the last 6 or 8 months, that has been broken into. The amount of money taken from those will not average over $1.50 a meter. The majority of them are very small. One very funny thing happened. We had two meters, one right beside the other; one was broken into and one was not. The one that was broken into contained 25 cents; the other contained $6.75. I presume likely the man who made the theft found there was so little in the one he broke into that he would not take the trouble to open the other one.

The President—Mr. Baker, will you please reply?

Mr. Baker—I would like to say, in reply to my friend in the front here, who said that in a small company all the knowledge they have is the knowledge in the head of the cashier, that that used to be the way in our company. Of course, it is now so large that the cashier would not have the time for it; but even in the small company wouldn't it leave him where he began if his cashier should pass away or get transferred? Then as to our notice that the collector will call to-morrow for the $3. I rather inferred that he thought it would cause friction. Well, it does not. We talk in the gas business of educating the people; we always say we educate them to do this or that. I believe I heard it remarked here this morning that we should train them to read their meters. If you let the first payment on your gas stove slide over a few days, the average foreign consumer, to use a slang phrase, thinks you are easy, and when your next dollar payment comes along it is likely to go another week or two, until finally you are going to have $4 or $5 in arrears. Then you have to say, "Give up, or we will take the stove." Even if sending out these notices and insisting on getting the first payment, which with us is $3, does cause friction at the beginning of the campaign, I think that a little friction for a few months, or for whatever time is necessary, is worth while when you consider the ease in getting in your money that you will enjoy in all the years after you have educated your people to it. In regard to the prepayments, I will say that we used to make change in the till, as the gentleman on my left says, but we found that took time. It adds to the cost of reading prepayment meters considerably, and as compared with the cost of reading straight meters it runs it up a great deal. We take all the money. One man is in charge of the consumers' ledger that has prepayments in it. We keep the prepayments in a separate small ledger, ruled just the same as our other ledgers. He keeps a running footing of all the feet used, and a running memorandum of all the money. Suppose it does fall 25 or 50 cents below this month; it probably has gone up 75 cents a few months back and we are even, so we say nothing. If there is any great discrepancy, why then that particular meter is taken out, tested and examined, and a thorough examination given to find whether the fault is in the meter reader or in the collector, or whether it is in the mechanism of the meter. Of course, the footing of the prepayment ledger always shows an overplus, and we take care of that on our bookkeeping by putting it in our liabilities, making an entry debiting prepayment sales wtth the footing of the meters at $1 per 1,000, which is our net rate, and crediting it with the actual money received. It shows an overplus of $15 to $25 a month. In that way we always know what we owe on prepayment meters. We also change our meter readers every month. No meter reader is allowed to read the same book 2 months consecutively. We start the reader out at the beginning of each month with a different book, and he gets another book when he brings the first in. We don't know what book he will take out the next time, it all depends on what book he brings in; but he does not get the same book in 2 consecutive months.

Mr. Barnes—In answer to the question by the Secretary, I would say that in Cambridge our rule in regard to the setting of prepayment meters is that we will not set a meter where anyone outside of the consumer or his family has access to it. If it is in a building where there are two or more meters in the same cellar, we decline to set a prepayment meter. The only exceptions we ever made in that case were when people have been willing to make a deposit of $5 or $10 for the security of the box for the convenience of having a prepayment meter. They have made that proposition themselves, and we have in one or two instances accepted it. Otherwise than that, the rule is that the meter shall be under the exclusive control of the consumer, and shall only be accessible to him or to some member of his family.

The Secretary—In reply to Mr. Barnes I would say that in my limited experience with prepayment meters I have found this works admirably when I wanted to head off the demand for a prepayment meter, but when a case came along where I wanted to put in a prepayment meter and the consumer was not willing to come up with a deposit or pay for a box I have the feeling that that rule rather ties my hands.

Mr. Prichard—Coming from the city of agitators, and hearing the talk about educating the consumer to read his meter, makes me think that it is about time for us to agitate the question whether a meter cannot be devised that can be read without the aid of the differential calculus. That is stretching it a little, but it is a matter of fact that the ordinary gas meter is an extremely difficult thing to read, for the ordinary person. I don't believe there are many cities in which you do not have from 10 to 50 mistakes a month made in taking your meters, and for everyone of those mistakes you have a man that goes about the city and tells what a swindle the gas company is. The most prolific source of complaint that we have in this whole business is the imperfect taking of the meters. Let a person have a bill this month of $1 and a bill next month of $3, and you may carefully explain to him that the first month's bill should have been $1.50 and the next month's bill should have been $1.50, but you cannot make him believe it if you talk till you are black in the face. Those mistakes are constantly being made. The only way in which we can educate the people to read the meters, and the only way that we can obviate the trouble of which I speak, is to have a meter that can be read by an ordinary person and that can be read quickly by any meter taker that we send out. I wish that we could start right here an agitation to see if that thing cannot in some way be brought about. [Applause.]

Mr. A. J. Campbell—In reply to the gentleman who last spoke, and in this connection, I would like to ask if anybody has had any experience with meter clocks, in which the position of the hands is marked instead of the reader putting the statement down in figures. Wouldn't that tend to obviate the difficulty?

Mr. Prichard—I had some experience in that way in taking electric meters, and it works very nicely. You can send anyone out to take the meter. I think it helps reduce the number of errors made.

Mr. Nute—I would like to say that the meter that Mr. Prichard is looking for is, I understand, about to be put on the market. It is a direct reading meter, which shows the figures. The figures appear above the regular dial of the meter. If the reading is 961, say, the figures appear there. I saw one of these dials 2 or 3 months ago, perhaps, and I understood it was very soon to be put on the market. It causes an addition of only two wheels, I believe, in the mechanism, and seemed to be a very simple and very nice arrangement. I understand it will make a very small addition also to the cost of the meter. I am very glad we are going to get it.

Mr. Mansfield—I used to find that teaching the people to read the meters was rather an easy way sometimes of getting rid of someone who thought there was a mistake in his bill, by showing him that if he knew how to read the meter he could easily see there was no mistake. A few minutes attention in that respect would possibly make them think that they were the mistaken party, after all. Then, perhaps, if you followed it up some time afterwards they would say, "Well, I went down to look at it, and I came to the conclusion that I would give it up." Still, perhaps the trouble that caused the excessively large bill may have been removed and the next one may have been all right.

Mr. Barnes—Touching the subject that Mr. Prichard has introduced, I will say that 2 or 3 years ago I had a talk with a prominent meter maker in Boston in regard to this very idea of a dial on the meter which would show the exact registration, something after the plan of a dial showing the number of revolutions of a crank of a steam engine. He told me that that had been tried, and experiments had been made. I think he told me that meters had been made in that way and found not to work well. I wonder if any gentleman in the Association has ever seen or heard of anything of that kind, or has had any experience with it.

Mr. Barnum—In Danbury, Conn., where they have several rather queer ways of making gas, they have a meter that has been used for a number of years, the dial of which reads directly in dollars and cents. When they first started to make gas there they made the price $10 per 1,000; to be sure they got it high enough. They still use those meters, but they have so many discounts to make that if a man wants to know how much his bill is he has to go through a calculation of 4 or 5 discounts to get the amount. The meter itself works all right, but it does not do what it was originally designed for, on account of the price of gas being changed. It performs one act however, it effectually covers up the actual price of gas per 1,000.

Mr. Allyn—I am simply going to throw out a hint that I thought our old friend Sherman must remember distinctly a meter that was

made, I should say, 35 or 40 years ago, in which the figures could be read distinctly. I remember that there were round openings in the dial through which the numerals appeared.

Mr. Sherman—I remember seeing such a meter, but have had no experience with it. I think it was made by W. W. Goodwin & Company, of Philadelphia. It never came into general use.

Mr. Hintze—Among the many relics left by the late John Andrew, to whose position I succeeded in 1892, was a 3-light meter with a dial the same as a steam engine counter, with numerals from left to right. I don't know what became of the meter or whether it was ever in use.

Mr. C. A. Learned—I suppose most of the members must be familiar with the reading on electric meters. Any of you that run an electric light plant have seen them. They work with very good results. You know, too, that the electric meter is a very intricate little piece of machinery. If the cyclometer reading will work well with electricity, I should think, with a pressure of anywhere from 1½ to 4 inches on a gas meter, it should work equally well.

The Secretary—I would not like to appear before this Association as opposing any suggestion put out by the member from Lynn, but I would like to ask one more question. I won't even ask the question, but I will just mention it. How many of you gentleman who think you know how to read a gas meter ever read your own meters? (Laughter.) That being the case, suppose you had a meter which would read in letters of fire, how many of you could get your present consumers to read it? To return to the question about the reading of consumers' meters, the thought occurred to me that possibly some of our bright advertisers who are so generous with their advertising matter, which they throw in with the stoves and other appliances that we buy of them, might be able to get up some sort of a novelty memorandum calendar, perhaps, which we could put out at no great cost to ourselves when we sell a gas stove, and have the selling agent in his most persuasive way present this to the lady operator of the cook stove and say that if she would hang this up at the side of her cook stove, and every week or few days note on it the reading of her meter, the chances would be that the bills would be satisfactory to the head of the house, and she could continue to use the gas stove instead of going back to the hot coal range.

Mr. Allyn—I desire to reply to our Secretary's question whether any of the gentlemen here ever read their own meters. I have a distinct recollection of reading mine once. That was on the occasion of my receiving a gas bill the month succeeding the installing of a gas range in my house. The bill was for $44. Thinking there must be some mistake, I read the meter on that occasion.

The President—I interpreted the applause that greeted the reading of Mr. Baker's paper and his closing remarks to signify the hearty appreciation of the Association for the work he has put into it.

We have an allied paper on a similar subject, and you will now give your attention to the reading of the paper on

GAS APPLIANCES,

by Mr. H. K. Morrison, of Concord, N. H.:

We are selling gas, and as sales' agents, superintendents, managers or under whatever name, our business is to create a demand for gas, keep up the demand and keep it growing. In view of this fact it is vital that every one of the various outlets for our product shall be in constant daily use.

We cannot overestimate the good our many friends do for us entirely unbidden and unpaid for, and on the other hand we constantly underestimate the harm a disgruntled customer is always sowing; for it is almost second nature to speak of the bad and not the good in anything. In order to make our customers our friends and get their valuable help it is necessary to do all we can in the line of recommending and selling only the best and most economical appliances for using that which we are selling, Gas. An inefficient article should have no place in our lines of goods. Such will never help keep up the demand.

If we admit the foregoing, then it seems to me that upon the complaint department is a large burden of responsibility in the getting of new business as well as of holding the old, keeping up the demand and keeping it growing. To it belongs the labor of seeing to it that every appliance is in such shape at all times that it will economically utilize that for which it is an outlet, "*Gas.*"

In the enumeration of the causes of the many troubles known to us as complaints, we may name two or three which seem to affect our new business.

1. The putting out of poor appliances by ourselves or by others. We would classify under this head poor burners and tips and all appliances so constructed that they are not adapted to our special need. Gas fixture houses and plumbers have a way, for instance, of supplying a 3-foot tip for any and all orders. These in a great majority of places are worthless and should never be allowed to be put on fixtures. Alas, they are; and if anyone cause exists for the common kick, "poor gas," it is caused by burners not adapted to either the kind, quality or pressure; and it is not a great step from "poor gas" to "big bills," and all kinds of abuse and the loss of an old or prospective customer.

2. Interference by others than employees. There are numerous people who must be tinkering with everything. No matter how carefully we may adjust our appliances, someone, ignorant of cause and effect, there will sure to be who knows better, knows it all, and makes a vital mistake. These troubles generally get to the complaint clerk and are remedied. If not they must be sought out and remedied or again we lose in one or both classes of customers.

3. The poor work of our employees. Eternal vigilance seems to be needed to prevent poor work, improper construction, leaks and all kinds of trouble caused by employees. If promptness in correcting any mistake is necessary in answering trouble of this class it surely should be the invariable rule. Happy the company and numerous its friends whose employees never leave a leak, never over or under read a meter. (Why don't meter makers use an index that can't be incorrectly read?) never talk too much, etc., etc. Inefficient employees, like inefficient appliances, should be the rare exception, if we wish our friends to advertise us.

4. Appliances which need some periodical inspection, under which class I have in mind particularly gas stoves and other large users of gas which have been sold, and presumably in use years without inspection and without complaint. This does not mean, however, that there may not be cause for complaint, or that the stove is even in use at all. I should here like to emphasize the need of a house-to-house inspection of stoves specially; such inspection should be made not by a fitter but by a skilled cook, preferably a woman, who is full of tact and good common sense. One who cannot only detect poor adjustment but improper handling of appliances and suggest methods of economy, and whenever necessary give lessons in the cooking of plain, everyday food. She will get behind the scenes and possibly make some discoveries that will surprise you, and she will do far more good here than before an audience. She may find the ovens not in use or some particular oven universally unsatisfactory. I have known of such a case, as no doubt did every other woman acquaintance in that town within reach, and more than one sale was blocked on account of it. She will find out what a man never could.

I believe the same careful and regular inspection should be made of gas engines by an expert in that line. I know of one case where a customer tinkered with an engine a whole week and then called in the services of the gas company. It took about 10 minutes to set it straight; not only did the customer lose a week but the gas company a week's consumption. An inspection would probably have prevented it.

No doubt much cumulative evidence can be brought out to show the intimate relation of one's old business and how we care for it, to our new business and what it costs to get it. If I have succeeded in merely calling attention to it I believe this attempt will have paid.

Light, heat and power are the three outlets for our product. Keep them before the public in every way possible; yes, but of equal importance, keep every appliance in use in condition to do its work economically, and you will have won half the battle of keeping up the demand, and at the same time will have decreased the cost and increased the profits on new business.

Discussion.

The President—Is there to be any discussion on this paper? It is axiomatic in its character, with good, sound advice. I take it that we all agree with what Mr. Morrison has set forth. If the members will give their attention we will now proceed to call the roll.

ROLL CALL.

The Secretary called the roll, the responses thereto being as follows:

Honorary.

Col. Frederick S. Benson, Brooklyn, N. Y.

Active.

Addicks, W. R., Boston, Mass.	Cooper, A. F., Exeter, N. H.
Africa, W. G., Manchester, N. H.	Coyle, P., Charlestown, Mass.
Alden, G. A., Watertown, Mass.	Crafts, H. C., Northampton, Mass.
Allen, B. J., Allston, Mass.	Eccles, A. D., Ware, Mass.
Allyn, H. A., East Cambridge, Mass.	Ellis, J. W., Providence, R. I.
Anderson, W., Chelsea, Mass.	Erhard, T., East Cambridge, Mass.
Barnum, D. D., Worcester, Mass.	Farnum, G. W., Lowell, Mass.
Burritt, D. F., Portsmouth, N. H.	Fish, R. E., Taunton, Mass.
Coffin, J. A., Gloucester, Mass.	Fowler, S. J., Charlestown, Mass.
Coggeshall, H. F., Fitchburg, Mass.	Gifford, N. W., East Boston, Mass.
Cook, R. W., Providence, R. I.	Gould, J. A., Boston, Mass.

Goulding, N. O., Natick, Mass.
Hassett, E. J., Beverly, Mass,
Hawken, T., Rockland, Me.
Hintze, T. H., Lowell, Mass.
Humphreys, C.J.R., Lawrence, Mass.
Humphreys, J.J., Jr., Coney Island, N. Y.
Jenks, Z. M., Woonsocket, R. I.
Jennings, F. W., South Framingham, Mass.
Lane, H. M., Leominster, Mass.
Leach, H. B., Taunton, Mass.
Learned, W. A., Newton, Mass.
Learned, C. A., Meriden, Conn.
Leonard, C. F., Fall River, Mass.
Manchester, G. L., Easthampton, Mass.
Mansfield, G. W., Salem, Mass.
McGregor, W., Pawtucket, R. I.
McKay, W. E., Boston, Mass.
Morrison, H. K., Concord, N. H.
Moynahan, J. F., Stoneham, Mass.
Nettleton, C. H. Derby, Conn.
Norton, H. A., Boston, Mass.
Norton, W. F., Nashua, N. H.
Norton, P. T., Nashua, N. H.
Nute, J. E., Fall River, Mass.
Nutting, C. H., Chicopee, Mass.
Prichard, C. F., Lynn, Mass.
Quinn, A. K., Newport, R. I.
Richardson, F. S., North Adams, Mass.
Sargent, F. S., Lawrence, Mass.
Shelton, F. H., Philadelphia, Pa.
Sherman, F. C., New Haven, Conn.
Sherman, C. D., New Haven, Conn.
Slater, A. B., Jr., Fort Wayne, Ind.
Spaulding, C. F., Waltham, Mass.
Spaulding, C. S., Newburyport, Mass.
Spaulding, W. H.
Spear, J. N., Boston, Mass.
Stearns, W. M., Waltham, Mass.
Stevens, C. F., Haverhill, Mass.
Stone, A. F., Chelsea, Mass.
Travis, F. M., New Haven, Conn.
Walker, W. L., Fitchburg, Mass.
Walker, E. L., Hyde Park, Mass.
White, C. E., Wakefield, Mass.
Wood, W. A., Boston, Mass.
Woodward, R., Pittsfield, Mass.
Yorke, E. H., Portland, Me.

Associate.

Baker, S. E., Fall River, Mass.
Barnes, A. M., Cambridge, Mass
Baldwin, C. H., Boston, Mass.
Chaney, F. V., Boston, Mass.
Coburn, C. M., Chelsea, Mass.
Cortis, D. T., Boston, Mass.
Gardiner, W. H., Jr., Boston, Mass.
Griswold, C. F., Meriden, Conn.
Hinman, C. W., Charlestown, Mass.
Holmes, R. E., Winsted, Conn.
Humphreys, F. W., New Haven, Conn.
Mace, F. W., Lynn, Mass.
Norton, A. E., Boston, Mass.
Scranton, G. H., Derby, Conn.
Thomas, F. W., Boston, Mass.
Tufts, J. P., Boston, Mass.
Waldo, C. S., Boston, Mass.
Waldo, J. A., Boston, Mass.
Wilder, C. C., Springfield, Mass.

[To be Continued.]

Central Station Gas Engines.

[A paper read by Mr. C. H. Williams, of Madison, Wis., at the Second Meeting of the Wisconsin Gas Association.]

The central station men of neighboring States have shown a keen interest in the experiment which has been carried on during the past year at Madison, where gas engines have been installed to furnish the motive power of a central station electric generating plant. Here both steam and gas engines are operated by the same company, although the two plants are entirely separate, and the expenses which each occasions are kept distinct, so that each type of engine has been given an opportunity to demonstrate its relative economy.

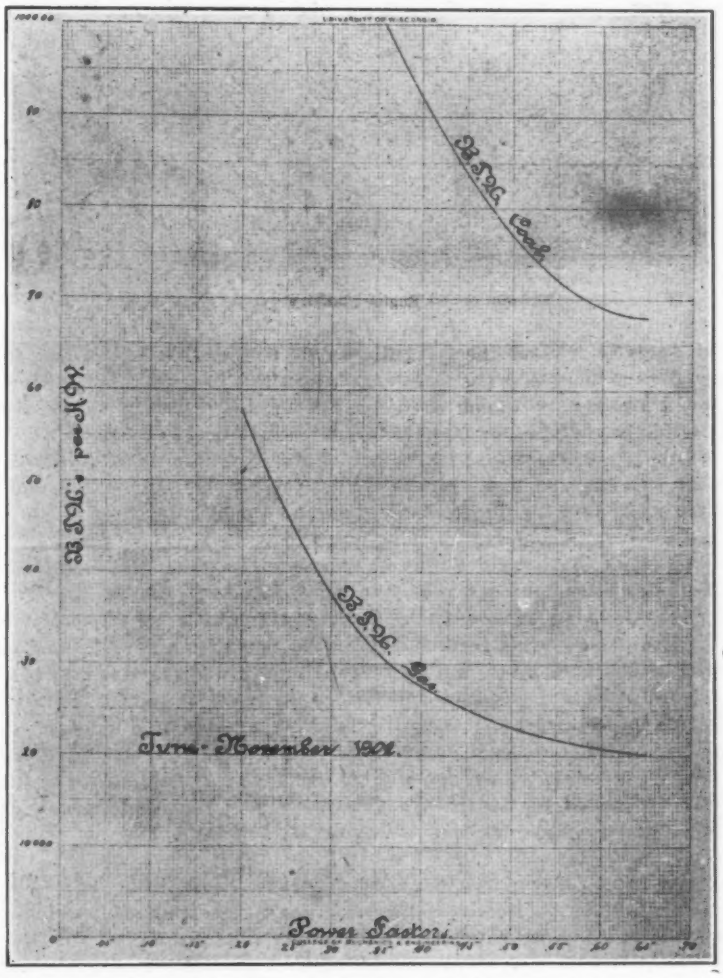
The steam plant under consideration contains 4 Russell-tandem, compound condensing engines of 450, 380, 250 and 100-horse power, respectively, two of which are direct connected to generators, while the other two are belted. The steam for this plant is furnished by two 350-horse power Hazelton and a 200-horse power Sterling boilers.

The gas engine equipment consists of one 125-horse power and two 280-horse power Westinghouse 3-cylinder, vertical type engines, operating on coal gas, the same as is sent into the mains for commercial purposes. The generators at the gas engine plant are all belt driven, and two of the engines have been in operation since February, the third having been installed during the month of October last. Careful records have been kept each day since starting the gas engine plant, showing the number of pounds of coal consumed, the number of pounds of water evaporated, together with the kilowatt output for the steam station, and the number of cubic feet of gas consumed, the gallons of water used for cooling, and the kilowatt hour output at the gas engine station.

Both plants have been doing the same kind of duty, and all the conditions maintained were such as to bring out the best station economy in both plants. The steam plant had this advantage, in that it was loaded heavier in comparison to its capacity, but this difference has been cared for in making the comparison in the following way: After determining the number of watts generated per pound of coal and per cubic foot of gas, recording the pounds of water evaporated per pound of coal, and the gallons of water used per kilowatt hour in the water jackets, a calculation was made of the load factor under which the engines were operating. The particular load factor taken into consideration was that obtained by dividing the kilowatt hour output by the capacity of the engines, times the number of hours during which they ran, which determined the average load under which the engines were operated.

A comparison of these load factors, along with the consumption of gas per kilowatt hour under different loads, shows that the gas consumed in the gas engine when working below full load is proportional to the work done, plus a certain constant, and this constant is found to be the amount of gas consumed when the engine is working with no load. For this reason, as the load drops off the actual amount of gas consumed increases per unit of work quite rapidly. In this respect the gas engine follows closely the action of the steam engine under similar conditions.

In order to show at a glance the relative thermal efficiency of the two kinds of engines, curves are plotted showing the consumption of



heat energy for the two types of heat motors when operating under the varying loads which the station happened to experience each individual day during several months.

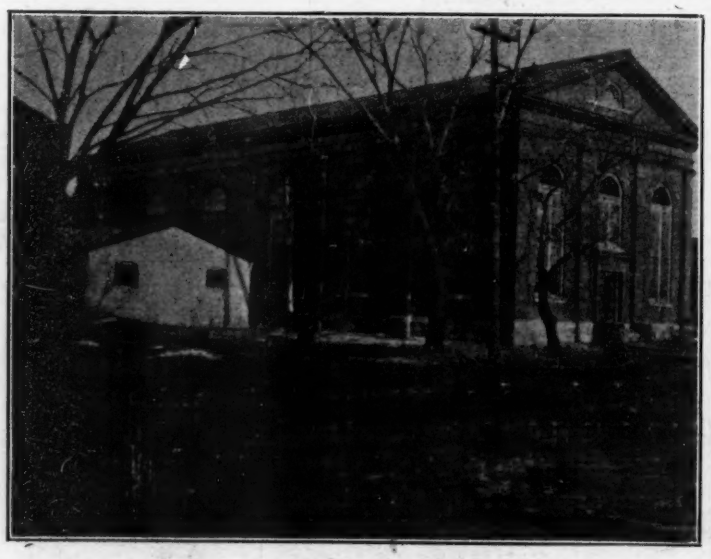
Different shifts showing the same load factor showed about the same consumption of gas and coal per kilowatt hour, but to insure a correct average all shifts having the same load factor during each month were grouped together, the average consumption of fuel, whether coal or gas, was determined, the corresponding equivalent in heats units was determined, a point plotted with a certain load factor as abscissa, and a certain heat consumption per kilowatt hour as ordinate; a corresponding point was then found for each load factor, both steam and gas, and a smooth curve was drawn through the individual points.

In every case the heat consumption for gas is considerably below that for coal, and it is noticeable that the steam curve tends to parallel the horizontal axis at a much higher value than would the gas.

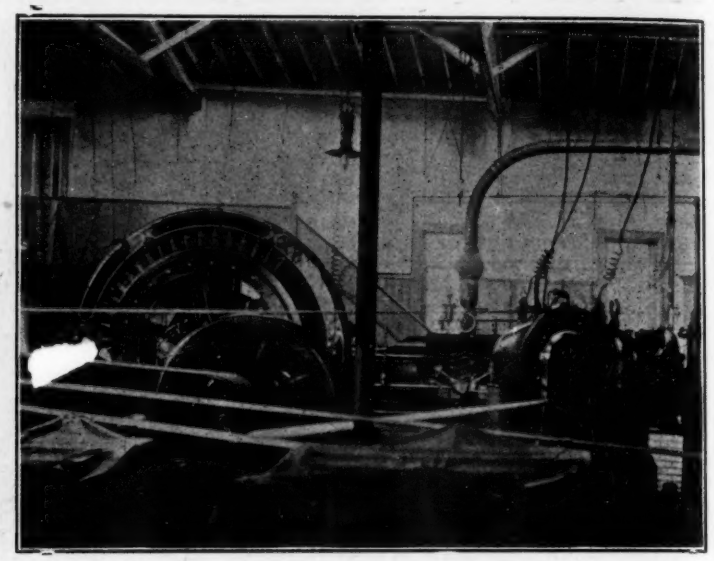
In obtaining the data for the development of the heat curves, 650 B.T.U. was found to be the thermal value of a cubic foot of the gas used, and 13,000 B.T.U. was the value found per pound of coal.

These figures are taken from everyday, actual working conditions, and a gas man knowing the cost of gas in the holder and the heating value of his coal gas, together with cost of his steam coal and its calorific value, can immediately arrive at the generating cost per kilowatt hour which would be incurred should he use engines of equal efficiency to those at Madison.

During the time that the gas engines have been in operation at Madison no troubles have come up which in any way interfered with continuity of service. The repairs to the engines have been limited to such cases as where changes have been made in piping on the water cooling apparatus, and these repairs were not necessitated by any wearing out of parts, or by breakage. The engines are operating everyday,



Exterior of Gas Engine Plant and Battery House.



300-Kilowatt Monocyclic Unit at Steam Plant.

18 hours a day, and there is fully as much confidence felt in their reliability as there is in the operation of the steam engines. There are so few working parts which can get out of order that the attendance is at least no more than that given to the steam station. The attention which these engines demand is systematic and intelligent, but they do not require much. One man operates the gas engine plant, and at the same time looks after the storage battery and boosters for the street railway, and he does not complain of being overworked.

Although the length of time of operating the gas engine plant has been limited—about one year—the behavior of the engines has been such that the management feels that they stand on a par at least with the steam engines, as regards certainty of operation and cost of maintenance and attendance, and that they stand far in advance of the steam engine, in that the cost of generation per kilowatt hour is reduced. They can be started and stopped in a fraction of the time necessary to stop and start the steam engines, and further, that the standby losses are entirely absent when the engines are not in operation, while the cost occasioned by the steam boiler when it is kept standing under pressure represents considerable, being in the neighborhood of 10 per cent.

The steam engine has one advantage that the gas engine cannot claim, and that is its ability for overload at a time of emergency, for at such a time the steam pressure may be increased and a greater engine capacity be obtained, while the gas engine has a definite point beyond which it is impossible, with present construction, to go, and relief must be had by installing additional engine or storage battery capacity, or providing some means for supplying the power external to the engine itself. Still, this can hardly be charged against the gas engine as being something lacking, for if the engine will do all that the builders claim for it, it must be admitted that it has fulfilled its requirements, and it is a very poor policy to figure on the overload capacity of machines to carry the peaks with nothing to fall back upon.

Up to the present time the gas used at the Madison plant has been the ordinary coal and water gas generated in the Company's gas plant, and from an operating standpoint the coal gas has been very satisfactory. On the first starting up of the engines experiments were made with water gas, but it was found that, due to the high flame temperature and the low point of ignition, this gas was not suited for use in the engine cylinders, as the compression was set for coal gas. The mixed gas worked better than the water gas alone, but the straight coal gas was so much more satisfactory, both from an operating standpoint and from the cost of fuel per kilowatt hour generated, that nothing but coal gas has been used since that time. When a gas engine is used to furnish power on a small scale, the convenience of using ordinary coal gas compensates for its comparatively large cost, but for operating on a large scale some cheaper means of generating gas is essential.

In steel and other metallurgical works a cheap gas is made by letting a limited quantity of air pass through a bed of incandescent coal or coke, the gas which is formed in this way consisting of carbonic oxide, formed by the union of the carbon with the oxygen of the air, and diluted by the nitrogen of the air, which passes through without any chemical change. This gas is too weak to be effectually used in the ordinary gas engine built for coal gas, and is valueless so far as use under a furnace is concerned, there being present but about 30 per cent. of combustible gas. If in the generation of this gas the supply of air is cut off after the bed of fuel has been brought to a high temperature, and steam is admitted in its stead, water gas would be formed, which would consist of about 90 per cent. of combustible gas, but the gas which has come into most general use as a substitute for coal gas has a value somewhere between the two gases spoken of above. This gas is made by sending a jet of mixed air and steam through a chamber containing incandescent coal or coke. The steam is generally formed in a small boiler in connection with the apparatus, and this blows through a form of injector in which it takes up air, the two passing together into the hot carbon chamber.

The gas which is formed by this process consists of a mixture of about 25 per cent. carbonic oxide, and 20 per cent. hydrogen, the remainder being nitrogen, which gives about 45 per cent of combustible matter. After leaving the producer the gas is led through a scrubber, thence into a holder, from which it is fed into the engine. Such a plant has the advantage of taking up but a small amount of room, and requires but little attention.

The quantities of gas and air admitted are so regulated that just enough oxygen is obtained from the air to maintain the fuel bed at the proper temperature to support the chemical changes which go on when the steam is decomposed and the gas formed.

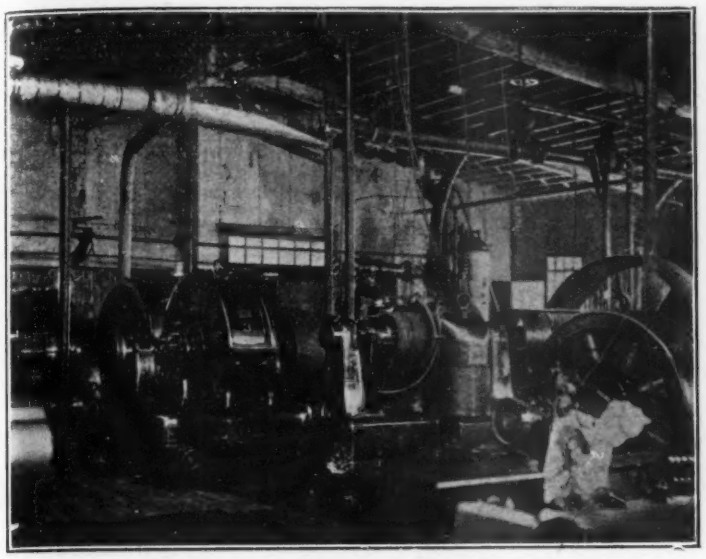
The gas obtained from this kind of a generator has about one-fourth the calorific value of ordinary coal gas, and when used in an engine, if the quantity of air admitted to the cylinder is cut down and the compression carried to a higher point than is necesary with coal gas, it is found that the mixture ignites very well, develops a high initial temperature and gives an indicator card very similar to that obtained by ordinary coal gas. Gas made from anthracite coal is better for gas engine work than that obtained from bituminous coal, because it is cleaner, is free from sulphur and ammonia, and yields no condensable vapor or tar. No purifier is used on this "producer gas," as it is called, the gas being merely scrubbed in a scrubber containing coke moistened with water. Another substitute which has come into quite general use, especially abroad, is that known as the "Mond gas."

It is well to keep the amount of hydrogen in producer gas down as low as possible, for it is necessary to run the compression up in producer gas engines, bringing the gas in closer compact to assist in rapid combustion, and to increase the cylinder capacity—and if the percentage of hydrogen is large it is liable to cause premature ignition, as the hydrogen ignites at a lower temperature than the rest of the gas; again, it is well to keep the percentage down because so much heat is rendered latent in the combustion of hydrogen which cannot be recovered without recondensation of water.

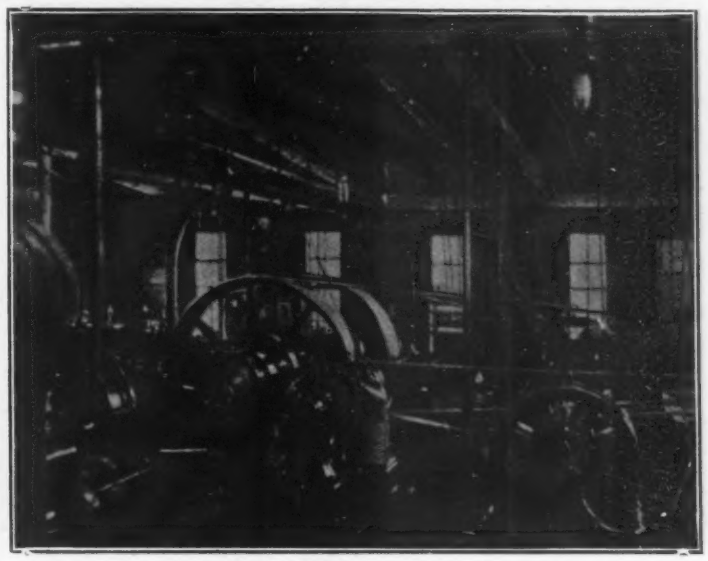
If the compression should be made less on account of danger to premature ignition, the burning of the gas is liable to be delayed, should the amount of hydrogen be lessened through any variation in the working of the producer—and small producers are very apt to give a varying amount of hydrogen.

Experience has shown that the degree of compression for these different gases should be inversely as the calorific value of the gas used.

The advantage gained by increased compression is partly mechanical and partly thermodynamic, for apart from the consideration of efficiency, compression increases the power of an engine relative to its



Dynamo Room of Steam Plant from Shaft to Monocyclic Unit.



Dynamo Room of Steam Plant from Cylinder of Monocyclic Unit.

size, by causing a larger quantity of gas to enter into action, so that a larger amount of heat is generated at each explosion, and consequently a larger mean effective pressure is exerted during the working stroke. Besides increasing the power, compression produces an increase in efficiency, because the higher pressure reached at explosion allows a greater range of expansion to follow without causing the pressure to fall to a point unduly low.

When the terminal pressure is maintained the same, an increase in compression increases the area of the indicator card for the same charge of gas, and the reduction of the volume in the clearance space gives a smaller surface for the cooling of the gas at the dead point, and where the engines do not use a scavenging device the decreased clearance means a decreased quantity of burnt gases left over to mix with the incoming charge.

Theoretically, the ordinary gas engine is at fault in its operation in that combustion begins at a time when the working substance is still comparatively cold, and, consequently, part of the heat is taken in at a relatively low temperature.

In the design of the Diesel motor there is an effort to do away with this defect, by compressing the air to a very high degree before admitting the fuel. This being done, the fuel is injected slowly into the cylinder, allowing the expansion to go on at the same time, and so approximately securing combustion at a constant temperature, after which the supply of fuel is cut off and a long expansion follows.

In the Diesel motor the advantage of compression is realized to a greater extent than in any other engine built. The operation is carried out in the ordinary, 4-stroke Otto cycle, and a small air pump delivers air at a pressure of about 700 pounds per square inch, which is a higher pressure than is reached in the main cylinder. The high pressure air is used to inject the liquid petroleum fuel into the clearance space where it burns as it is admitted under a pressure of from 500 to 600 pounds, the temperature due to the pressure being sufficient to create combustion without the aid of any auxiliary igniting device.

In tests on a 20-horse power Diesel motor, as high as 34 per cent. of the heat has been converted into indicated work, and 26 per cent. has been converted into work on the flywheel. This is, I believe, the highest efficiency yet reached on any practical form of heat engine. The Diesel motor renders the use of gases rich in hydrogen possible, for there can be no premature ignition, as no fuel is admitted until the proper time, and this does not explode but simply burns quietly as an ordinary jet.

Outside of the question of mechanical construction, there is no limit to the compression which can be carried in this machine. In the ordinary gas engine the whole charge is exploded at, or near, the dead point, and this causes a very high local temperature, and consequently a great deal of heat is lost to the walls of the cylinder and to the jacket water, and when ignition takes place later there is a quicker conversion of heat into work, as the crank has proceeded further in its revolution.

The Diesel motor has a lower initial temperature, and as fast as the heat is generated it disappears in the form of work; there is then a smaller difference in temperature between the working substance and the containing walls, and consequently less loss of energy to the jacket. From a thermodynamic point of view the water jacket of the ordinary gas engine is an absurdity, absorbing about 50 per cent. of the energy as it often does, and it is only tolerated because it is impossible to otherwise deal with the high temperatures, or because it has heretofore been impossible to make the cylinder work without its use. The Diesel motor requires a cooling jacket, but less heat is lost in it, as pointed out before, and, therefore, it is a step in the right direction. If it is found practicable to separate the combustion chamber from the working cylinders, the loss of heat due to the jacket and water may be entirely removed.

Besides the loss due to the jacket another source of loss which is excessive in the gas engine is that due to the large quantity of heat which passes out and is lost at the exhaust. It is somewhat difficult to determine the composition of the exhaust gases as well as the temperature at which they leave the engine; the composition being hard to determine because the gases leave the cylinder at a high temperature, and when they are cooled for analyses there is considerable condensation, followed by absorption of the CO_2 by the water vapor.

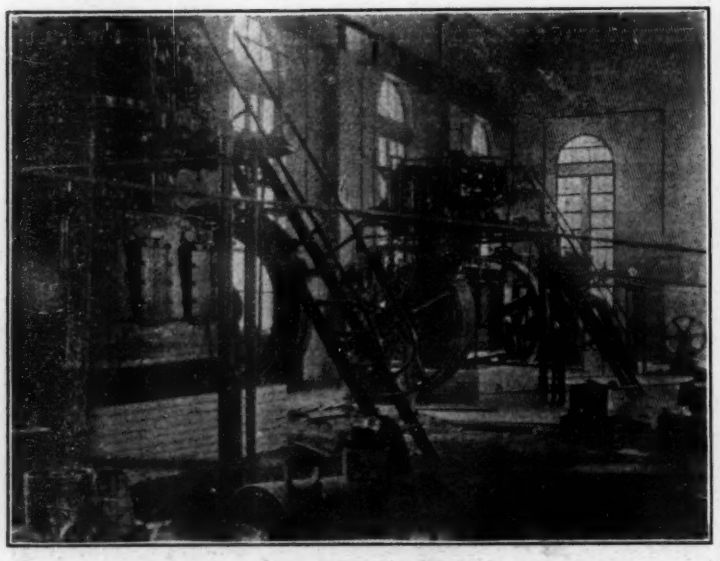
Considerable work has been done by endeavoring to utilize this heat which comes from the exhaust, either by using it to heat water in connection with a boiler plant, or to use the heat in another engine using a different working substance which is capable of being worked at a lower temperature without dealing with pressures which are inconveniently low.

It is useless to try and expand ordinary gas to atmospheric pressure because in the last stages of expansion the pressure would barely move the piston against its own frictional resistance, and so the indicated work which would be saved by completing the expansion would add nothing to the output of the engine. For this reason it has been proposed to use what is called a "binary" heat engine; that is, an engine with two working substances, one to work through the upper part of the range, and another substance, such as ether, to work through the lower part. Such schemes have been experimented with in connection with steam engines for 50 years, but they have never as yet gained any commercial footing.

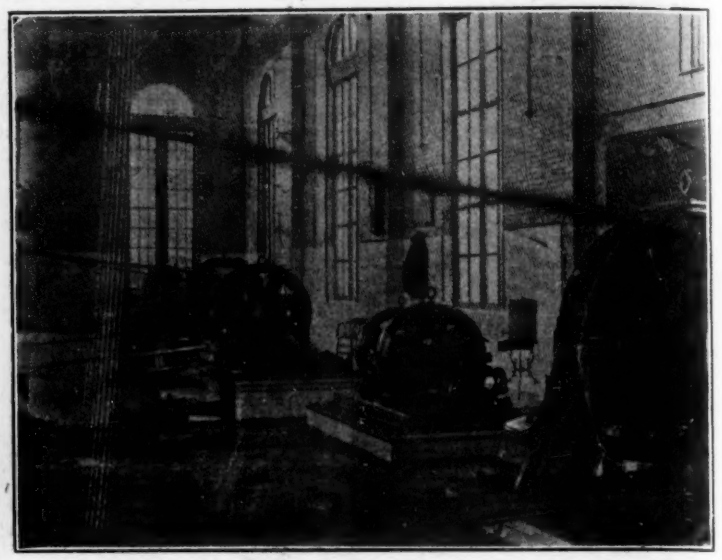
Returning again to the subject of producers. The amount of fuel which is used under the boiler for producing and superheating the steam must be charged to the producer, and taking this into account the heat loss is about 20 per cent. in a small and 15 per cent. in a large producer, or the efficiency is about 80 per cent. for a small and 85 per cent. for a large producer. The repairs and depreciation are about the same, and certainly are no more for the producer operating under small pressure than for the boiler and all its accessories which have to contend with the steam pressures used in the modern plant.

A 300-horse power producer plant showed under test that less than 5 pounds of fuel were wasted per hour when standing idle for 15 hours, with but a small current of air being admitted to keep the fire alive. This was determined by placing the producer on a weighing machine and determining the loss of weight. Some of the reasons why the stand-by losses on the gas producer are small, as compared with the boiler plant, are that the grate surface is much smaller, as is also the surface presented for cooling, and, further, no chimney is used, so that when the blast is closed there is no tendency for any circulation through the fuel bed and the combustion takes place very slowly.

Attention was called to the fact that better results were obtained when the quantity of burnt gas left in the cylinder was decreased;



One 18 x 14 and Two 1⁸ x 2² Vertical Type Westinghouse Gas Engines.



Generators Belted to Gas Engines.

this gas is left in the clearance space at the end of the exhaust stroke in most cases where engines work on the Otto cycle, and it mixes with the incoming gas in the following stroke, diluting it and causing trouble oftentimes from premature explosion in large engines by the incoming gas being ignited with the hot burnt gas which is left. Different methods of clearing the cylinder or scavenging out this burnt gas have been resorted to, and very satisfactory results have been obtained. One scheme is to have a separate air pump which opens to the working cylinder and removes the burnt gas by displacing it. Another scheme is to open the air valve a little sooner than the gas valve, and a little before the end of the exhaust stroke; a long exhaust pipe is attached to the engine, and as the exhaust is discharged with a puff, the energy of motion in the long exhaust pipe causes a partial vacuum, which sucks in the air and scavenges or frees the cylinder of burnt gas.

One company so designs its engines that a wad of clean air is interposed between the exhaust gas and the burned gas; which is claimed to prevent their intermixing. Manufacturers building scavenging engines claim that from 15 per cent. to 25 per cent. can be gained by properly removing the products of combustion from the cylinder, and builders in this country as well as those abroad have been doing a great deal of successful experimenting along this line with large engines. It is natural to feel a keener interest in the work of American engineers than in those of foreign countries, and our own engineers have made very rapid advances in the development of large engines, but we still have to look abroad to see how far the work has actually been carried.

During September last, Mr. Herbert Humphrey read a paper before the Engineering Section of the British Association, on the "Recent Progress in Large Gas Engines," and one has but to glance at this contribution to appreciate the tremendous advances which have been made along this line abroad. This paper, as read by Mr. Humphrey, does not take into consideration any engines under 200-horse power capacity, and it shows an aggregate of over 180,000-horse power of engines now in operation.

The product of American shops represents about 25 per cent. of the total horse power, and it is interesting to note that it is the American engineer who is experimenting on the largest scale, one American firm building 2 gas engine gas compressors of 4,000-horse power each, while this same company has orders for an aggregate of 14,500-horse power. Another American firm, building a 1,500-horse power engine for dynamo drive, has an aggregate production of 17,800-horse power.

It has been the writer's privilege to see a 250-horse power double-acting, two-cylinder, horizontal engine, of the four-cycle type, direct connected to an electric generator, and working very satisfactorily; also, a 1,000-horse power horizontal gas engine gas compressor, besides a 1,000-horse power double-acting, two-cycle, scavenger-type, horizontal engine, for direct connection to a 3-phase generator. This last machine was assembled but not in operation, as the generator was not ready for operation. The 1,000-horse power compressor engine is operating on natural gas, the 250-horse power on producer gas, and the 1,000-horse power unit is to be used on blast furnace gas.

One of the foreign builders has, through its licensees in this country, taken an order for 32,000-horse power of gas engines, the order being made up of sixteen 2,000-horse power machines.

When the amount of work which is being undertaken along these lines is considered, it is evident that many of our foremost engineers believe that the gas engine has at least passed beyond the experimental stage. There is a case on record already abroad where gas engines of 8,000-horse power are to be employed in transmitting 3-phase current a distance of 5 miles to a rolling mill, and the present installation of 2,000-horse power of steam engines, although of modern type, and barely 3 years old, will be displaced.

One point which seems to have been an obstruction to the general adoption of the gas engine for central station work is its adaptability for direct connecting to alternating current generators. Electrical engineers agree that direct current machines can be operated together satisfactorily when directly connected to gas engines, but they are divided in opinion as to the handling of alternators in parallel.

The question of operating alternators in parallel has always been surrounded by more or less mystery, and generally connected with some long drawn out mathematical formula. For successful parallel operation it is a fact that the cyclic variation of the driving engine must be maintained within certain limits, depending on the design of the dynamo and the kind of load which is to be handled.

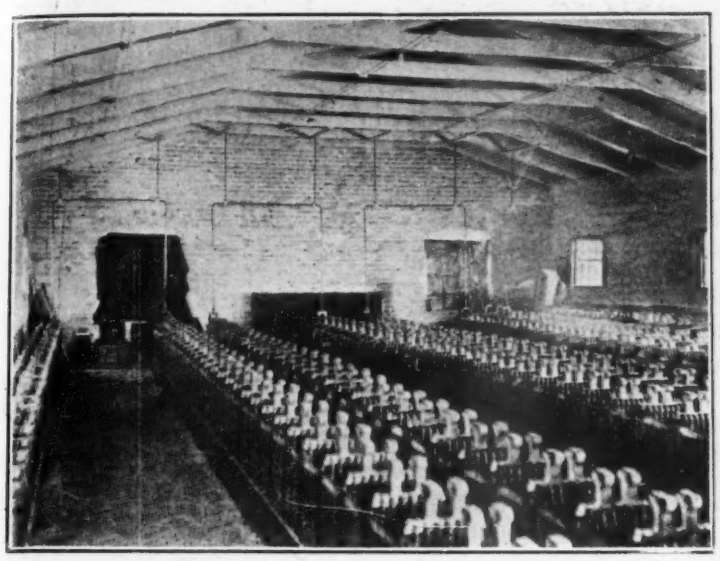
Machines operate best together when the frequency is low and the speed of the armature high, when the armature has considerable self induction and when the load is non-inductive. Under ordinary conditions, when the frequency does not exceed 80 cycles, the cyclic variation may be approximately 1-200, and we now have gas engines with flywheels of moderate weight operating with a cyclic variation of but 1-350.

Heavy flywheels do not improve parallel operation except by limiting the cyclic variations; in fact, too heavy a flywheel may even hinder successful parallel operation in the following manner:

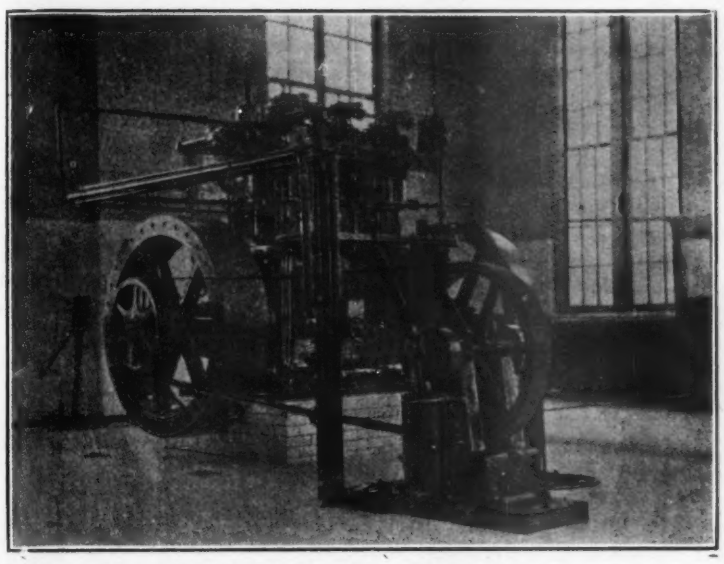
Suppose a relative displacement takes place between two alternators operating in parallel, cross currents will flow which increase the work done by the leading machine, and decrease that done by the lagging machine, which tends to pull the two machines together. The greater the displacement becomes the greater the synchronizing effort made by the two generetors, so that the leading machine puts energy into the flywheel of the lagging machine all the time during which it is behind and catching up again. The result is that the flywheel in catching up will be given such an extra impetus that it will jump ahead of the other machine, and the heavier the flywheel the greater the tendency to swing by. Again, increasing flywheel weights greatly increases mechanical friction, and oftentimes the heaviest loss by friction is the mechanical power required to turn the flywheel. For this reason the flywheel should be the last resource for securing uniform motion, and attention should rather be devoted to obtaining uniform crank efforts by increasing the number of impulses, by having them come at equal intervals and by properly balancing the reciprocating parts.

A great deal can be done by the designer of the generator in the mechanical construction of the machine, which will aid materially in preventing the trouble of parallel operation.

With these requirements in view, and without going into the possibilities of the gas turbine, we may look for the future gas engine to be a double-acting, multicylinder machine, regulated by a throttling governor, which will adjust the point of ignition to suit the load and maintain the compression a constant without regard to the quantity of mix-



Storage Battery for Taking Care of Street Railway Peaks.



125-Horse Power Engines Driving Direct Current Generators and Air Compressors.

ture admitted. Experience has shown that electric ignition—and that in duplicate—is safer, and compressed air has been found to be the most satisfactory means of starting. The engines will probably be constructed horizontal, either tandem or double tandem, as horizontal engines are cheaper and easier to build.

In regard to average gas engine efficiency: The small gas engine of the 4-cycle type, working on illuminating coal gas, consumes on an average about 20 cubic feet of gas per horse power hour, when working full loaded; the larger sizes get down in the neighborhood of 15 cubic feet.

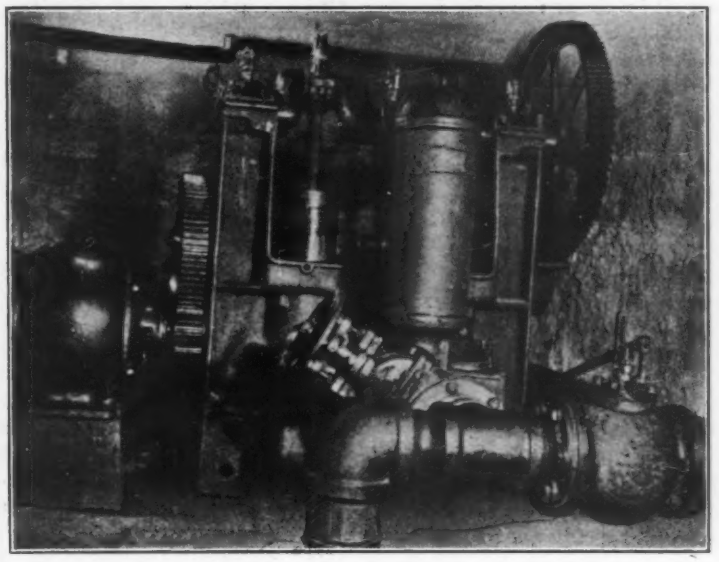
The mechanical efficiency is generally between 80 and 85 per cent., or, in other words, 20 cubic feet per horse power hour means 23 or 25 cubic feet per brake horse power hour.

Ordinary coal gas has a heating value which ranges from about 480,000 to 620,000 foot pounds per cubic foot, and, considering 520,000 as a representative average value, the heat which is equivalent to 1-horse power would be given by the consumption of 3.8 cubic feet of gas, and so an engine which consumes 19 cubic feet per 1-horse power hour has a thermodynamic efficiency of 20 per cent.; that is, it converts just 20 per cent. of the energy of the fuel into work.

Efficiencies ranging from 20 to 34 per cent. have been reached in trials with gas engines using high compression and means of scavenging, and on investigation we find that the most efficient steam engine converts less than 15 per cent of the energy of the fuel into work, and with steam engines which are small enough to compare fairly with the gas engine to which the first figures refer the fraction converted is rarely 10 per cent.

The superiority of the gas engine over the steam engine from a thermodynamic point of view is then considerable, and it is due primarily to the greater range of temperature through which the working substance is carried, and especially to the high mean temperature being developed by the combustion of the substance itself. The days of the steam engine for central station work are surely numbered, for if a change of the boilers and steam engines to gas producers and gas engines can show a saving of half the fuel, it will be impossible to prevent its being done.

In the preparation of this paper the writer has freely consulted the contributions of engineers both of this country and abroad in an endeavor to lay before you some of the result of their work along this line.



View in Tunnel—Motor Driven Triplex Pump Supplying Circulating Water to Engine Jackets.

A Water Power Plant near Grenoble, France.[1]

A water power plant, chiefly interesting, perhaps, from the fact that it uses a hooped steel concrete conduit for conducting the water, has been completed at Champ, in Isere, France, on the Drac river, about 9½ miles above its confluence with the Isere river, near Grenoble. A net head of 105 feet has been utilized and waterways have been provided for harnessing 600 cubic feet of water per second, or sufficient to develop 7,200-horse power. The plant is of the class in which the water is conducted as far as practicable in open canal and then by a pipe line to the turbines. The pipe line is 10.82 feet in diameter, and the first portion of it, that is, until the head becomes 65.6 feet, is of the reinforced concrete. The plant was described recently in *Le Genie Civil*.

The head works are located at a point where the river issues from a gorge and flows into a wide plane leveled by its deposits. During floods, when over 42,000 cubic feet of water are passed per second, the stream takes a width of more than 3,000 feet; while under ordinary conditions, the discharge amounts to 2,120 to 2,830 cubic feet, and the stream only occupies a channel which it cuts out in its deposits, frequently changing its course. The water for power purposes is diverted by means of a fixed submerged dam, which extends from the left bank of the stream toward the head gates of the canal. The gate structure runs from the right bank in a direction parallel with the stream, and between its outer end and the river end of the dam there is located a movable dam, to set up a stronger current of the river, or a larger volume of flow across the front of the gates.

The fixed dam is a mass of concrete 426.5 feet long, 39.4 feet thick at the base and 6½ to 16½ feet high, according to the depth of the river bed. The concrete is covered by heavy riprap to protect it against disintegration from gravel carried by the torrent, which, it appears, is commonly heavily charged with sand and stones. The top of the dam is scarcely more than 5 feet above the stream bottom. The movable dam contains two gates 26.24 feet wide and 4.92 feet high, operated from a footbridge supported at one end by a pier between the movable and the submerged dams and at the other end by the head gate structure. The pier and the bottom or apron of the movable dam rest on a metal caisson, 55.8 x 19.7 feet in size, lowered 32.8 feet below the bottom of the fixed dam by means of compressed air. Here again, to protect against erosion by the gravel, the top of the caisson is covered with a flooring of oak joists 5.5 inches thick, fixed under the corners of the caisson and by bands of iron, 3.28 feet apart on centers fastened by bolts imbedded in the concrete.

The head gate structure consists of a concrete wall, 262.5 feet long,

1. *Engineering Record.*

pierced by 15 openings 6.56 feet wide and 4.92 feet high. The openings are protected by a rack of iron bars extending the length of the wall and of the usual construction, except that the flat iron bars are inclined slightly downstream, like the slats of window blinds. so that pebbles entrained by the current produced by the open movable dam cannot easily reach the intake canal. The wall of the gate structure is built on piles, around the heads of which was spread a mass of concrete 6.28 feet thick. The water entering the head gates flows into a settling chamber and from this into the open canal. The settling chamber, which covers an area of 2,990 square yards, takes the form of a mouth to the canal, and the flow of water from it into the canal occurs over a stop wall, 1.96 feet high above the bottom of the chamber. This is apparently designed to catch sand, and the settling chamber has an overflow wall, running from this stop wall to the head gate structure, 4.26 feet above the bottom of the chamber, to discharge excess water into the river. For flushing out the settling chamber, a number of waste gates are provided.

The canal is nearly 2,000 feet long, and varies in width from 196.8 to 72.18 feet with a depth of 4.9 to 13.1 feet. It is built partly in excavation and partly of embankment; its banks are protected by a lining of concrete, and it has a slope of 4 in 1,000. Under normal conditions, with the plant working at full load, the mean velocity of the water in the canal is about 1.14 feet per second, which allows sand in suspension to deposit. When it is desired to clean out the canal, the flow of the water is increased by opening six discharge gates and closing the head gates. The forebay, built of concrete walls, has an area of 1,075 square yards and a depth of 13.1 feet. It is divided into two compartments separated by a wall 3.9 feet high. The first compartment receives the water from the canal, and its purpose is to change the direction of the current and to catch sand. It is about 65 x 100 feet in size, and extending across it at right angles to the direction of the flow of the canal there are six gutters formed in its bottom, each leading to a discharge opening by which the water can be wasted into a canal leading to the river. These six wasteways have already been referred to. At the opposite end of the chamber from these discharge openings is the wall, 100 feet long, separating the two chambers. The water passes over the top of this wall, which is 3.28 feet above the bottom of the first chamber. The second compartment varies in depth from 13.1 to 23 feet and leads at its lowest end into the trumpet shaped mouth of the pipe line.

The pipe line, as already stated, has a diameter of 10.82 feet. It has a slope of 7 in 1,000 and is 15,090 feet long, 6,890 feet of it being of reinforced concrete construction and the remaining 8,200 feet of soft steel plates. The reinforced concrete section is subjected to a maximum pressure 65.6 feet of water and is of hooped steel concrete, with walls 7.87 to 9.84 inches thick. The hoops are of round iron, 0.433 to 0,880-inch in diameter, and they encircle round iron bars 0.236 to 0.472-inch in diameter, which run longitudinally with the pipe. The hoops and the longitudinal bars are fastened together by wires and form meshes of 3.9 x 4.3 inches on centers. The concrete was put in place between a a center or mandril and two outside half-cylinder shells or molds. The pipe line is imbedded in a foundation of lime concrete filling the excavation made for it and is covered with a bed of earth and gravel about 15 inches thick on top and sloping 3 to 2 to ground level, this covering to protect it against outside temperature and resulting expansion changes. About 118 feet of conduit were built per day.

The steel conduit consists of riveted plates 0.27 to 0.59-inch thick, resting like the concrete-steel conduit on a bed of concrete in the excavation and protected by earth and gravel covering. The velocity of flow through the pipe line is 6.5 feet per second, and to avoid water hammer, in case of a sudden stoppage at the power station, three towers have been installed on the pipe line, two on the concrete steel portion and one on the lower end. The first tower is 29.5 feet high and 1,300 feet below the forebay; and the second is 65.6 feet high, placed at the junction of the hooped concrete and the sheet steel pipes. This is 3.6 feet in inside diameter. The third tower is 114.8 feet high, 10.82 feet in diameter at the base and 4.59 feet at the top. It is located at the end of the steel pipe line, of which it is in reality the prolongation. Its top is about 2 feet above the normal level of the water in the forebay, and is surmounted with a sheet steel reservoir, 9.84 feet in diameter and 6.56 feet high, from which three pipes 23.6 inches in diameter discharge into the tail race.

The generating plant is in a 144 x 39-foot building founded on concrete. It contains five direct-connected electric turbine units, each of 1,350-horse power capacity. The turbines are of the horizontal inward flow type with draft tubes of 16.4 feet effective length. They operate at 300 revolutions per minute and under full load pass 141 cubic feet of water per second. The alternators are 3-phase 3,000-volt 50-cycle generators with revolving fields. Current is stepped up for transmission purposes to 15,000 and 26,000 volts, by means of oil-cooled transformers and stepped down in substations. The efficiencies of the different portions of the plant are as follows: Turbines, 76 per cent.; alternators, 94 per cent.; transformers, 97.5 per cent.; transmission line, 31 miles, 94 per cent.; substation transformer and secondary transmission lines, 90 per cent. This gives a combined efficiency for transmission over the 31 miles with double transformation, of 58 per cent. The net cost of the installation per horse power delivered to the customer is about $230; the cost per horse power on the turbine shaft is about $105.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

HERE's a cheery sort of note from the "Only Aldrich," whose management of the affairs of the Spokane Falls (Wash.) Gas Light Company has been of the sort to satisfy consumer and shareholder—when a gas man can accomplish that feat he is all right. The note is dated from Spokane, "as of the 4th inst.":

Dear JOURNAL: Here's a news item for you. Our Directors met a few days ago and declared the usual 6 per cent. dividend for the past year on both classes of stock, in addition to expending $16,000 in betterments. We have decided to again reduce the price of gas to a maximum of $1.75 per 1,000 cubic feet. If the bill is paid on or before the 10th of the month, a rebate of 25 cents per 1,000 will be allowed. If there is another city in the United States of this size and existing conditions (with which you are acquainted) selling gas at our price, I want to know it. Remember our coal costs nearly $5 per ton in the coal shed. Our sales last year were almost 40 millions. The Directors also sanctioned the purchase of 5 miles of mains and such additional as necessary. As a starter for new business we are putting in a new gas cooking range, setting it up complete and making the consumer a present of 12,000 cubic feet of gas on payment of $24. The sole condition is that they will use a quantity of gas in 1 year from the installation of the range equal in value to the sum named. This offer is confined to those on our lines of mains who are using our commodity for light but not for fuel. Those not using gas for light or fuel may have a service put in free to the property line, paying 20 cents per foot from there to the meter. I will let you know the result later on, be it good or bad. Our increase in sendout for the past year was 20 per cent., notwithstanding we have had a strike and boycott on our hands for 9 months. We have, right or wrong, the desire to run our own business; but the stokers thought different, and as a consequence we are boycotted. They are now playing probably their last and strongest card—namely, threatening to draw or take out every man, woman and child in any store where gas is being used. This means that wherever men are at work on buildings or in a store they will be forced into leaving their employment until we accede to their demands. Well; we shall see. We have enjoyed very prosperous times for a few years, but there may be a change. And then, what?

AT the annual meeting of the Quebec (Can.) Gas Company the officers elected were: Directors, A. C. Joseph, Wm. Herring, Vesey Boswell, D. H. Geggie and R. H. Smith; Chairman, A. F. Hunt; Treasurer, T. H. Norris.

AT the annual meeting of the New Amsterdam (N. Y.) Gas Company the Directors elected were: Jas. Jourdan, A. N. Brady, E. S. Marston, Jno. Sloane, Emanuel Lehman, Jno. C. Tomlinson, W. A. Simonson, Moses Taylor, B. H. Church, J. W. Sterling, M. M. Graham, N. F. Brady and E. W. Doane.

THE Directors of the Sing Sing Gas Company, of Ossining, N. Y., have *reduced* the selling rate to $3 from $3.50 per 1,000 cubic feet.

MR. EUGENE SMITH, General Manager of the Peoples Gas and Electric Light Company, of Canton, Ills., writing to us under date of the 7th inst., says: "We have recently let the contracts for the reconstruction of our gas works. The plans call for the placing of new apparatus and half-depth benches, up to an output of 125,000 cubic feet per diem, with an ultimate capacity of 250,000 cubic feet when duplicated, for which extension provision has been made in the plans for the building that is to be erected. There will be little left of the old plant when the uew one is completed; in fact, the station meter and the holder only will survive, each of which is ample for the demand of some time to come. The Western Gas Construction Company and the Missouri Fire Brick Company are to do the work."

THE contracts for the placing in the works of the North Adams (Mass.) Gas Light Company of a half million cubic feet condensing, scrubbing, tar extracting and washing plant, and a half million purifying outfit have been awarded to Capt. William Henry White. The apparatus, which will be manufactured by the Western Gas Construction Company, is to be of the latter's standard type, save that the purifier plant will consist of 3 deep duplex boxes, instead of the customary 2. The North Adams Company will also put in compressors for supplying gas through high pressure lines to the adjoining towns of Williamstown and Adams.

GENERAL MANAGER PALMER, of the Niagara Light, Heat and Power Company, of Tonawanda, N. Y., says that the proprietors have just closed a contract with the Davis & Farnum Mfg. Co., of Waltham, Mass., for a storage holder of 100,000 cubic feet capacity. The holder will be erected at the Tonawanda plant of the Company. Under the new management of Messrs. Mason, Lewis & Co. the business is showing a good increase. Contracts will soon be let for the placing of about 12 miles of pipe on account of renewals of old mains, and several miles of new extensions will be made this spring.

MR. THOMAS A. ROCKWELL, President of the Fox River (Wis.) Gas and Electric Company, has purchased the holdings in the corporation heretofore owned by Mr. Henry C. Wood. That purchase puts Mr. Rockwell in control of the Company.

IN the reorganization of the Deadwood (So. Dak.) Company the following officers were elected: Directors, W. H. Harrison, Jr., J. A. Bower, Allen McDowell, J. R. Wilson and Grove Cothran; President, W. H. Harrison, Jr.; Secretary, Treasurer and General Manager, J. A. Bower; Assistant Secretary, Allen McDowell. The last named will also act as local manager of the concern.

A CORRESPONDENT incloses the following: "I understand that Messrs. Cramp, Mitchell & Serrill, Philadelphia bankers, have purchased the controlling interests in the gas and electric properties of Easton, Pa., and Phillipsburg, N.J., and propose to organize a company for consolidating them all. It is their intention to lay some 15 or 20 miles of new mains and to improve the gas and electric business to the highest possible standard. Furthermore, it is said that the selling rates for gas and electric current will be reduced as soon as the details of consolidation are perfected. Mr. A. B. Beadle will be the General Manager."

MR. FRANK D. MOSES, writing to us from Trenton, N. J., last Monday, says: "I have just finished a set of purifying apparatus for the Oneonta (N. Y.) Light and Power Company, and also have the following underway: A set of 10-foot by 12-foot purifiers for the Hempstead (L. I.) Company; 10-foot by 12-foot sets for Belmar, N. J.; 10-foot by 10-foot sets for Ocean City, N. J.; and an 8-foot by 8-foot set fer Swedesboro, N. J. All these are being constructed under the Beal-Moses system." Other contracts that Mr. Moses has in hand call for the overhauling and extending of the plants at Hanover, Pa., and Sunbury, Pa

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THE entire capital stock of the Gas Light Company, of Columbus, Ga., has been purchased by Mr. George J. Baldwin and associates, who are also in control of the local railroad and electric lighting systems. At the meeting for reorganization the following officers were elected: Directors, George J. Baldwin, J. B. Holst, Jno. F. Flournoy, A. A. Wilbur and F. E. Reidhead—Mr. Holst is the only representative on the Board that served in like capacity under the former ownership. President, Geo. J. Baldwin; Secretary and Treasurer, A. A. Wilbur; Assistant Secretary, H. P. Hayes, Boston, Mass.; Superintendent, James Ferrier. In an interview with President Baldwin, as to the future policy of the Company, he said: "No change will be made in the operation of the plant. It will be operated as in the past, and our desire will be to give a good service. Mr. Ferrier, who has been Superintendent of the plant a number of years, remains in that position. We will look into the matter of improving the property at once, and any betterments that are necessary to benefit the service will be made. The people of Columbus need not expect any advance in the selling rates."

THE gas works at Los Gatos, Cal., are being rebuilt. It is thought the overhauling will be completed by July 1st.

UNDER a bill introduced in the lower branch of the Minnesota Legislature by Mr. R. Chinnock, of St. Paul, it is sought to fix the maximum selling rate for gas in St. Paul and Minneapolis as follows:

Per 1,000 Cubic Feet.	Date.
$1.20	After July 1, 1903.
1.15	" " 1, 1904.
1.10	" " 1, 1905.
1.00	" " 1, 1906.

It is also provided that the gas shall have a minimum illuminating power of 22 candles. Under the circumstances it is not likely either Company affected will make strong protest against the proposed schedule.

THE Board of Supervisors of San Francisco, Cal., have passed an ordinance declaring that the selling rate for gas in that city during the next fiscal year shall not exceed $1.20 per 1,000 cubic feet.

THE inhabitants of Ludlow, Ky., have petitioned the owners of the Union Heat, Light and Power Company to extend the gas mains to and through the streets of Ludlow.

THE Mutual Gas Improvement Company, of Savannah, which is the virtual owner of the Mutual Gas Light Company of Savannah, has purchased much more than a controlling interest in the shares of the old Savannah Gas Light Company.

WE are indebted to a correspondent in Toronto, Can., for the following: "Some days ago Mr. Justice Street dismissed with costs the suit of the city of Toronto against the Consumers' Gas Company. The basis of the city's complaint was that the Company had committed certain breaches of its duty as defined by 50 Victoria, chap. 85 (Ontario), and that by alleged improper entries in its books and by a system of bookkeeping not in accordance with the Act, the price of gas had been kept at a higher figure than it should have been had the provisions of the Act been entirely observed. The city asked that the Company be ordered to comply with the Act and that the sums illegally overcharged to gas consumers be refunded. Mr. Justice Street held that by the evidence adduced the city was in error in the contention that the reserve fund had not been properly maintained; moreover, counsel had failed to show any injury to the city because of the administration of this reserve fund. In regard to the claim that certain sums written off the Company's assets had been charged to profit and loss or reserve fund, instead of to the plant and buildings renewal fund, the learned Judge said: 'The defendants were justified in writing these sums off the value at which their plant stood on their books, and it was a matter of no moment whether they were charged to profit and loss account or to the reserve fund, for the latter could only be increased from the former. The defendants were not bound, under section 6 of the Act, to charge these sums to the plant and building renewal fund, a charge for depreciation and loss not coming within the words all usual and ordinary renewals and repairs. Even if it were held that the amounts written off the profit and loss account for depreciation, which amounted in all to $321,431.38, should have been written off the plant and building renewal fund instead, the reserve fund would still be larger by the difference between these two sums, that is, by $44,491.85, than it would have been had defendants exercised the full rights given them by the Act.' In regard to the third objection that defendants were not at liberty to continue to the plant and building renewal fund the 5 per cent. authorized by section 6, because it did not appear to be necessary to do so for the purposes for which the fund was to be used under the statute, Justice Street says that it would be impossible to give effect to this objection without disregarding the plain and unambiguous language of the Act. His Lordship concluded with the statement that the action had entirely failed, and he therefore dismissed it with costs."

MR. J. S. BAHR has been appointed to the office custody of the business of the People's Gas Company, of Pottsville, Pa.

THE residents of Juniata, Pa., want the Altoona (Pa.) Gas Company to supply them with gas.

Engineering Record says that the necessity for careful covering of submerged pipes is shown by an accident described in the report of the Cambridge (Mass.) Water Board for the year ending November 30, 1902. A schooner grounded while coming through the draw at the Third street bridge, and as the tide went out it settled on a 12-inch water pipe and broke it.

THE AMERICAN GAS LIGHT JOURNAL

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Notification Respecting Advertising.—Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co. 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, MARCH 16, 1903

The Market for Gas Securities.

The continuance of "striking tactics," both in Albany and New York city, had a slightly further bearish effect on city gas securities. Consolidated sold at the lowest figure in months since last time of writing, and the close to-day (Friday) was made at 209 to 210. It looks a tempting purchase at these figures. City gas bonds are in good demand.

Brooklyn Union is nominally unchanged. The leading paper of that borough had an article this week outlining certain important plant extensions that were to be made by the Company. If the article told the whole truth amalgamation with the Consolidated Company would indeed be in the dim distance, but plans on paper are far from being realities in bricks and mortar. Shares in the San Francisco Gas and Electric Company are in active demand, at advancing figures, and the rise is thought to point towards an ending of the more than foolish gas fight that has been going on there for quite near 5 years. Rumor has it that the dividend on Louisville (Ky.) gas is to be increased from 5 per cent. per annum to 6 per cent. Washington gas is 420 bid, and Syracuse (N.Y.) bonds are quoted at 98½ to 100.

The change in the ownership of the Laclede Company seems to have much more significance than the surface indications point. The regular quarterly dividend of 2 per cent. by the U.G.I. Company is payable the 15th prox.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

MARCH 19.

☞All communications will receive particular attention.

☞The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	209	210
Central Union, Bonds, 5's.	3,000,000	1,000	109	111
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	118	120
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	310	325
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co.. Bonds, 5's	11,000,000	1,000	112⅛	113
Northern Union, Bonds, 5's.	1,250,000	1,000	106	107
New York and East River.. Bonds 1st 5's	3,500,000	1,000	112	113
" 1st Con. 5's	1,500,000	..	109	111
Standard	5,000,000	100	131	..
Preferred	5,000,000	100	152	..
Bonds, 1st Mortgage, 5's	1,500,000	1,000	115½	118
Yonkers	299.650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	216	222
" " Bonds (5's)	15 000,000	1,000	119	119½
Bay State	50,000,000	50	⅜	½
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	509,000	1,000	93	96
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	8½	10
" " Bonds, 5's	5,254,000	1,000	79	80
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Central San Francisco	900,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas & Elec. Co..	29,500,000	100	102	102½
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	101	101½
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	88¾	89½
Preferred	3,026,500	100	107½	109
Consumers, Jersey City Bonds	500,000	1,000	103	106
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	70	70¼
Mortgage, 6's	3,500,000	..	..	115
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	380,000	1,000	85	87
Consolidated G. & E. Co.'s. Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,825,500	50	..	89
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	281,000	1,000	77	79
" Inc. 5's	15,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	34	38
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	245	265
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	80	85
" Bonds, 6's	2,650,000	..	105	107
Jackson Gas Co.	250,000	50	73	75
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	99	101
Preferred	2,500,000	100	105	110
Bonds	10,000,000	1,000	109½	110
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	130	140
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	107½	108½
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	184¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	105	105¾
New Haven	1,000,000	25	300	325
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	101¾	102
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	52¾	53
St. Joseph Gas Co.				
" 1st Mtg. 5's	751,000	1,000	95	96½
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's..	2,465,000	1,000	92	93
Syracuse, N. Y.	1,975,000	100	42	45
Bonds	2,047.000	1,000	98½	99½
Washington, D. C	2,600,000	20	420	423¾
First mortgage 6's	600,000	..	..	..
Western, Milwaukee. Bonds, 5's	4,000,000	..	109½	110
Wilmington, Del.	600,000	50	232	..

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STOCKHOLDERS' MEETING.

OFFICE OF THE UNITED GAS IMPROVEMENT CO.,
N. W. CORNER BROAD AND ARCH STS.,
PHILADELPHIA, PA., February 27, 1903.

The Annual Meeting of the Stockholders of the United Gas Improvement Company will be held at the office of the Company, northwest corner of BROAD AND ARCH STS., PHILADELPHIA, on Monday, May 4, 1903, at 12 o'clock, noon, for the purposes of electing a President and six Directors, to serve for the ensuing year, considering and acting upon the subject of a proposed increase in the capital stock of the Company from 565,000 shares of the par value of $50 each, to 734,500 shares, of the par value of $50 each, and transacting such other business as may properly come before the meeting.

The stock transfer books will be closed from 3 P.M., April 28, until 9 A.M., May 5th.

By order of the Board of Directors.

1448-8 LEWIS LILLIE, Secretary.

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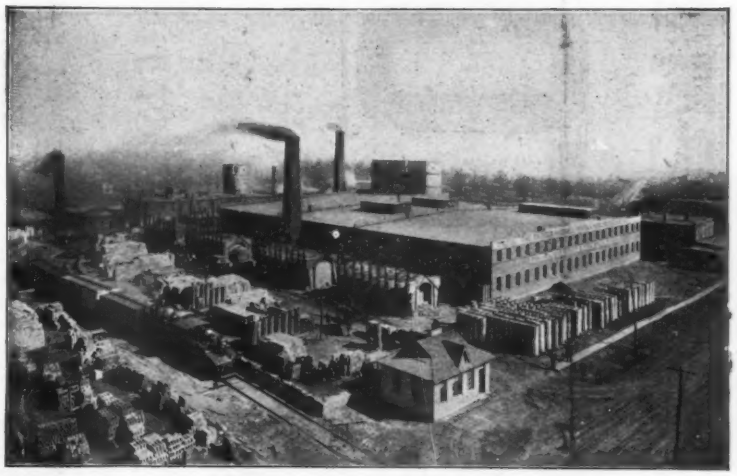

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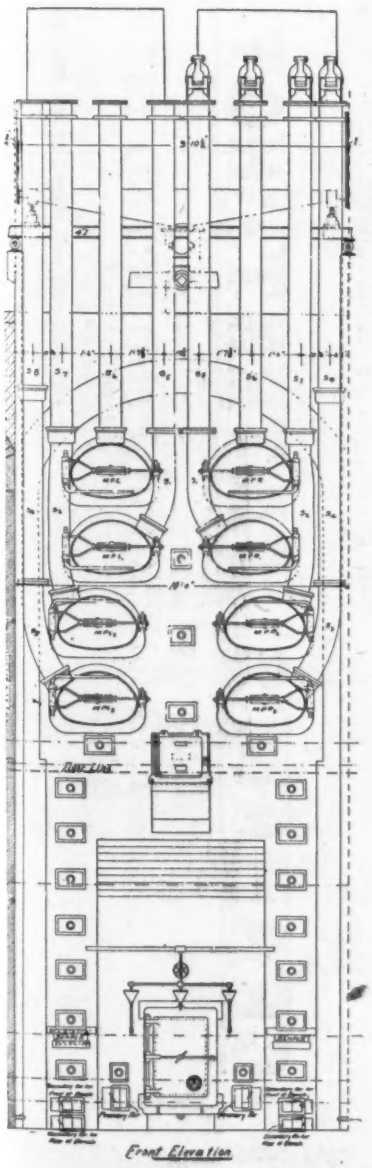

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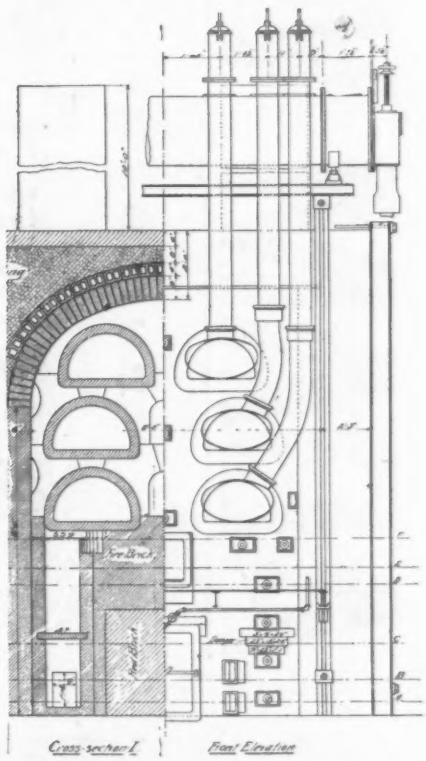

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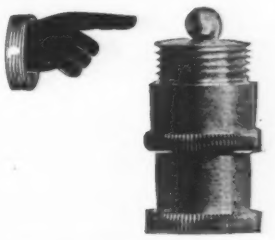

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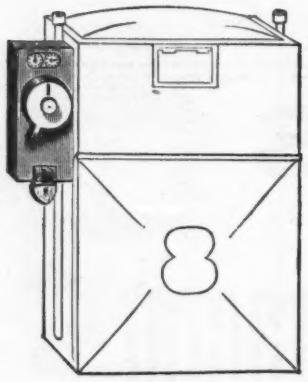

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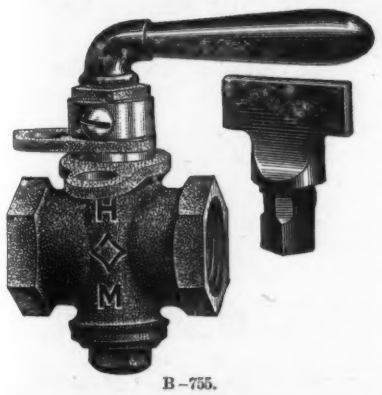

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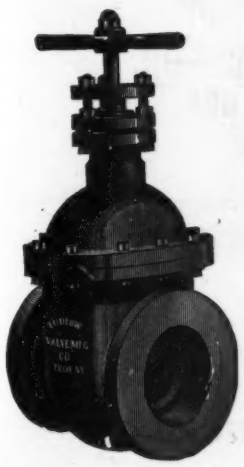

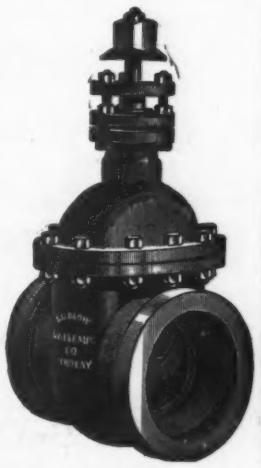

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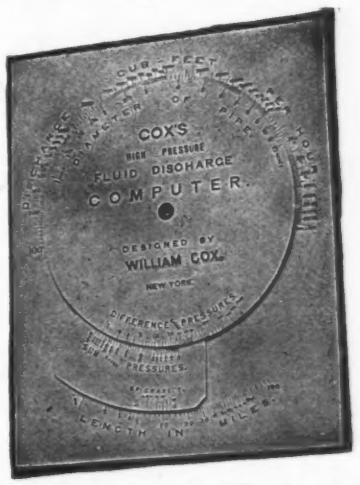

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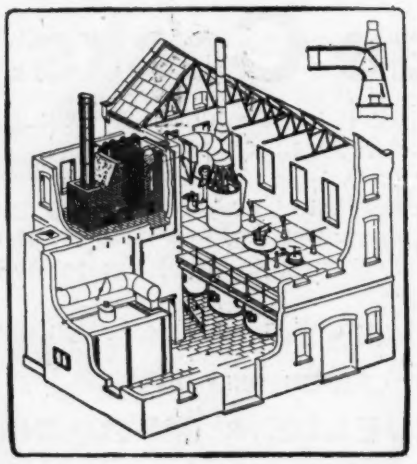

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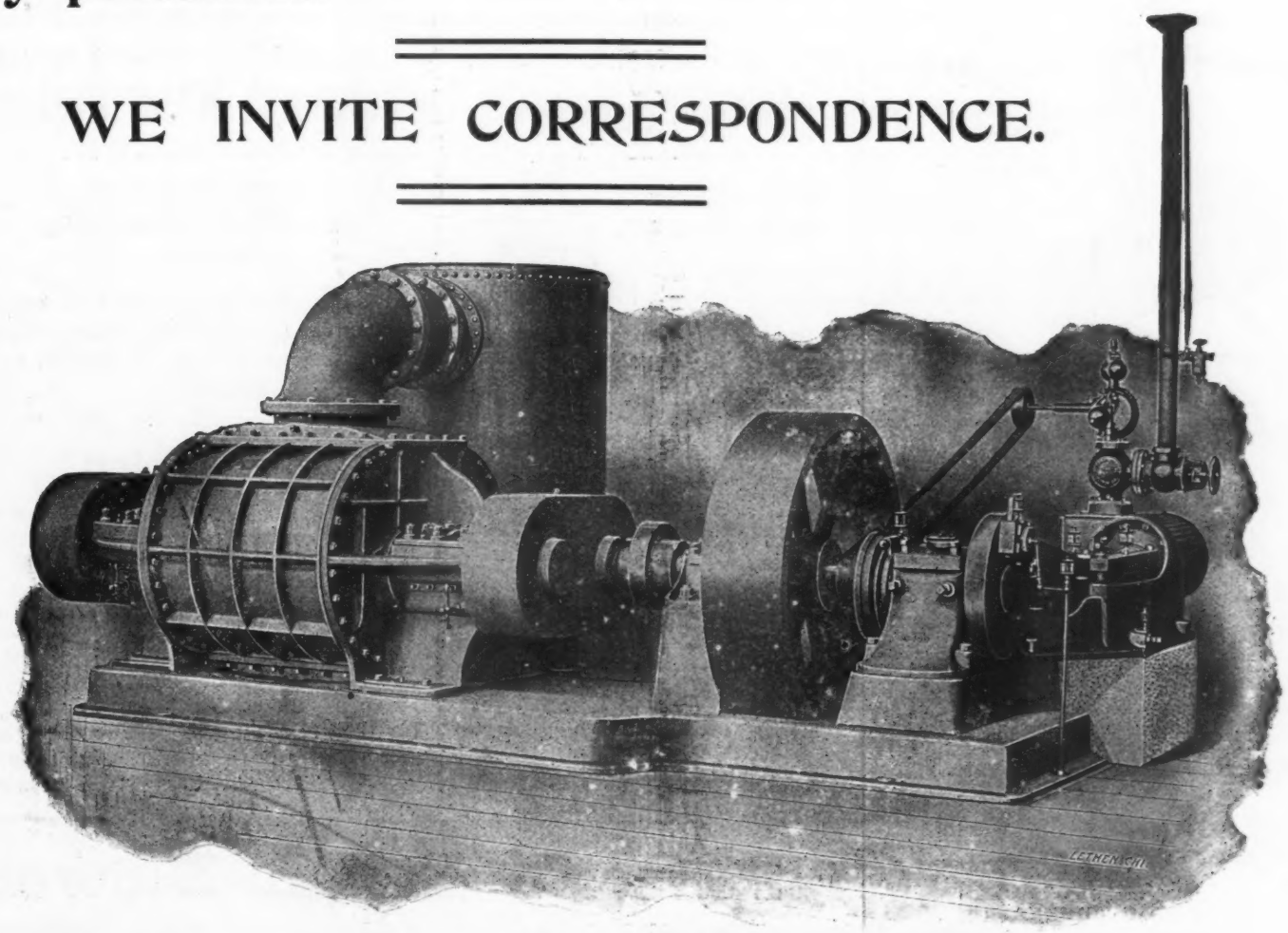

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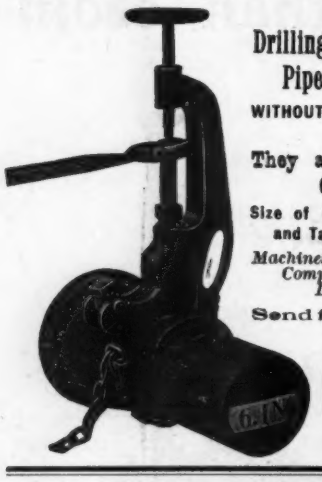
CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES



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Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

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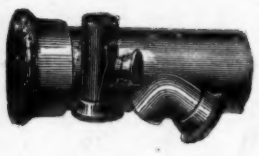

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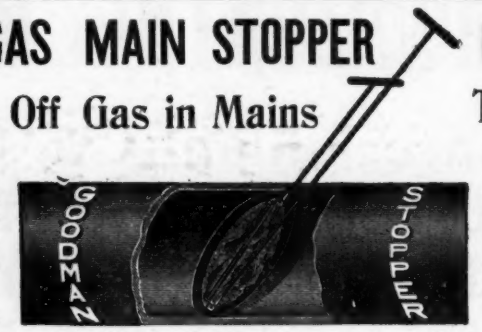

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This is Our No. 2 Heater.

Supplies hot water for domestic use as well as for the bath.

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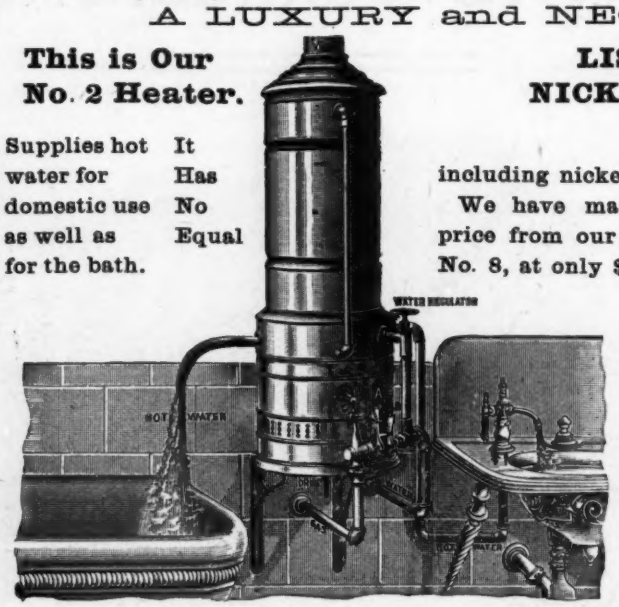

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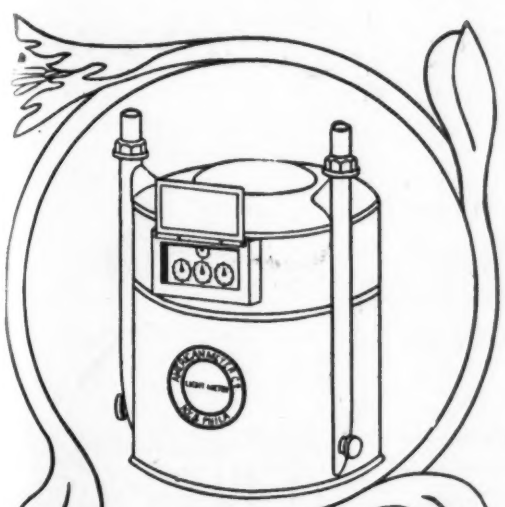
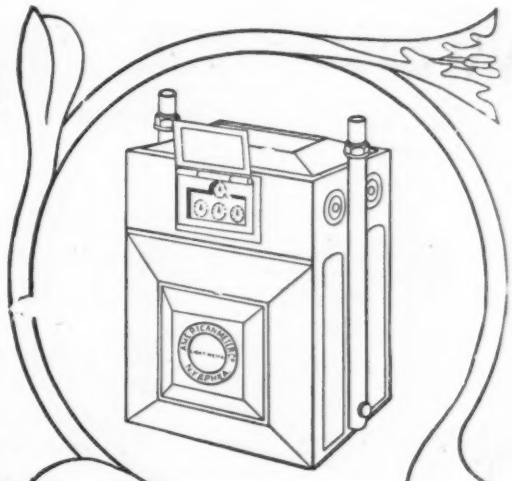
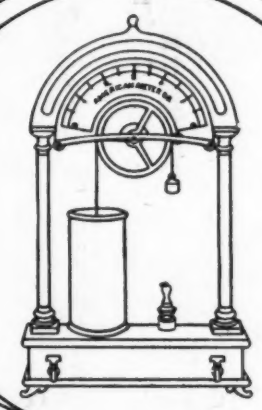
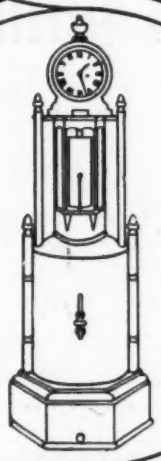
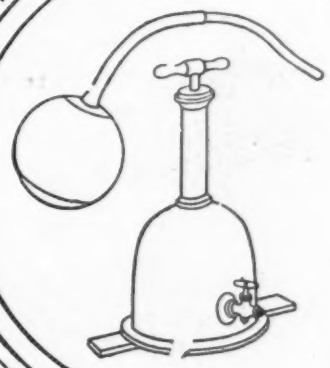
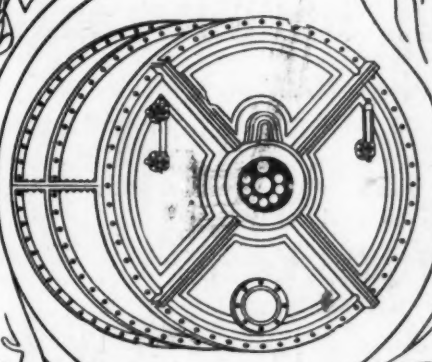


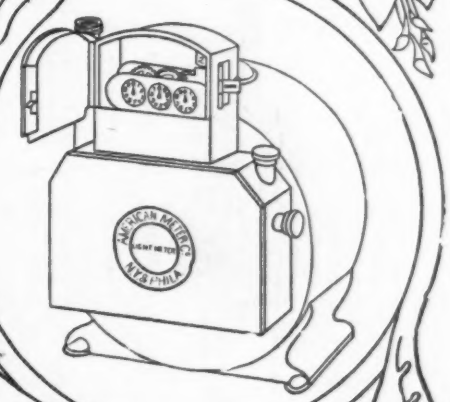












PUBLIC LIGHTING TABLE.

APRIL, 1903.

Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light.	Extinguish.
				P.M.	A.M.
Wed.	1	6.50 PM	4.50 AM	6.10	4.55
Thu.	2	10.30	4.50	6.15	4.40
Fri.	3	11.30	4.50	6.15	4.40
Sat.	4	12.20 AM	4.50	6.15	4.40
Sun.	5	1.10	4.40	6.15	4.40
Mon.	6	1.50	4.40	6.15	4.40
Tue.	7	2.30	4.40	6.15	4.40
Wed.	8	3.10	4.40	6.15	4.40
Thu.	9	3.40	4.40	6.25	4.30
Fri.	10	No L.	No L.	6.25	4 30
Sat.	11	No L. FM	No L.	6.25	4.30
Sun.	12	No L.	No L.	6.25	4.30
Mon.	13	7.10 PM	9.30 PM	6.25	4.30
Tue.	14	7 10	10.30	6.25	4.30
Wed.	15	7.10	11.20	6.25	4.30
Thu.	16	7.10	12.10 AM	6.30	4.20
Fri.	17	7.10	1.00	6.30	4.20
Sat.	18	7.10	1.40	6.30	4 20
Sun.	19	7.10 LQ	2.20	6.30	4.20
Mon.	20	7.10	2.50	6.30	4.20
Tue.	21	7.10	3.20	6.30	4.20
Wed.	22	7.10	4.00	6.30	4.20
Thu.	23	7.10	4.10	6.40	4.10
Fri.	24	7.10	4.10	6.40	4.10
Sat.	25	7.10	4.10	6.40	4.10
Sun.	26	7.20	4.10	6.40	4.10
Mon.	27	7.20 NM	4.10	6.40	4.10
Tue.	28	7.20	4.10	6.40	4.10
Wed.	29	7.20	4.10	6.40	4.10
Thu.	30	7.20	4.10	6.45	4.00

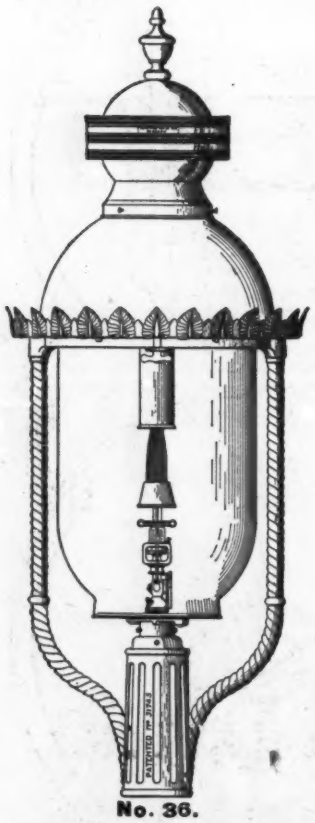
TOTAL HOURS LIGHTING DURING 1903.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	245.00	January	423.20
February	192.00	February	355.25
March	201.00	March	355.35
April	167.20	April	298.50
May	152.00	May	264.50
June	131.00	June	234.25
July	140.40	July	243.45
August	156.20	August	280.25
September	171.20	September	321.15
October	198.20	October	374.30
November	216.30	November	401.40
December	232.10	December	433.45
Total, yr.	2203.40	Total, yr.	3987.45

NEW YORK, 33 Nassau Street. PHILADELPHIA, Broad and Arch Streets. CHICAGO, Foot of Orleans Street. BOSTON, 624 Tremont Building.
CLEVELAND, 809 Cuyahoga Building. ST. LOUIS, 712 Roe Building. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



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Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

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IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

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The cut tells the story—but not all of it. Get one lamp and light it—then the tale's told from beginning to end. For one Welsbach Gas Arc Lamp is a better salesman than 20 pages of advertising.

Here's what it would show if you give it a chance to prove its worth:

1. A mechanical construction and finish that insures the greatest durability.
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3. The greatest amount of candle power with least consumption of gas.
4. A by-pass cock so constructed as to permit all or only one mantle burning at a time.
5. A pilot light that consumes but 1 foot of gas in 24 hours. Costs $\frac{1}{10}$ of a cent a day.

Give it a Chance to Tell its Own Story and it Won't Disappoint.

Let us send you one lamp—doesn't cost a fortune—and it will answer every question you put to it; make good on every test given it. You know the only proof of the pudding? What's the use in a fellow telling you it tastes good? Taste it yourself, then you know.

May we Send you ONE Lamp?

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THE UNITED GAS IMPROVEMENT COMPANY

During the Year 1902 has been Awarded Contracts in the Following Places for

Standard Double-Superheater Lowe Water Gas Apparatus.

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Auburn, N. Y.	Houston, Tex.	Ocean City, N. J.
Belmar, N. J.	Indianapolis, Ind.	Oklahoma City, O. T.
Blue Island, Ills.	Jersey City, N. J.	Oneonta, N. Y.
Boonton, N. J.	Laconia, N. H.	Plainfield, N. J.
Brooklyn, N. Y.	Lakewood, N. J.	Portland, Me.
Carlisle, Pa.	La-Salle-Peru, Ills.	Pottsville, Pa.
Champaign, Ills.	Martinsville, Ind.	Scranton, Pa.
Coney Island, N. Y.	Memphis, Tenn.	South Brooklyn, N. Y.
Dallas, Tex.	Newark, N. J.	Suffern, N. Y.
Danville, Ills.	New Brunswick, N. J.	Swedesboro, N. J.
Des Moines, Ia.	New London, Conn.	Syracuse, N. Y.
Evanston, Ills.	New Orleans, La.	Washington, N. C.
Evansville, Ind.	Norfolk, Va.	Woonsocket, R. I.

TOTAL SETS, 1902, ... 51
TOTAL DAILY CAPACITY, 1902, . . 32,825,000 cubic feet.
TOTAL SETS TO DATE, ... 447
TOTAL DAILY CAPACITY, ... 299,670,000 cubic feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
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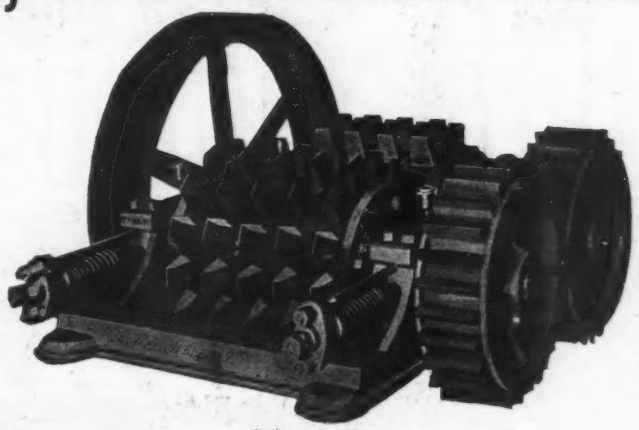

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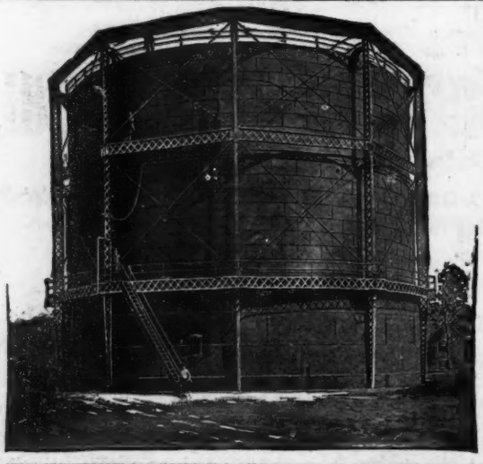

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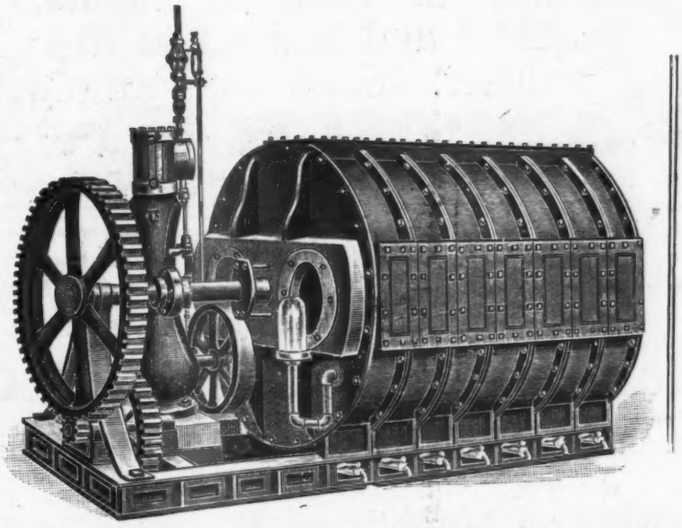

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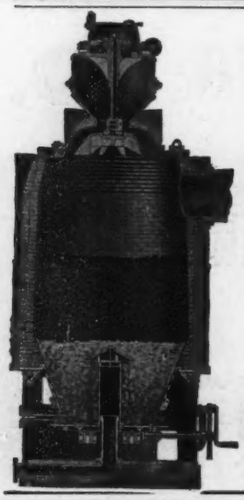

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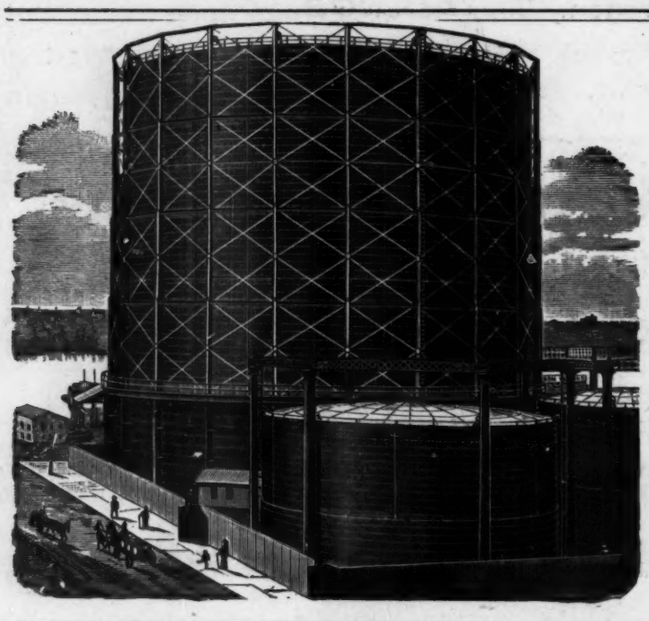

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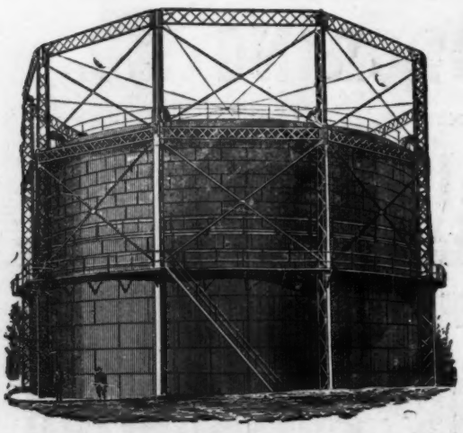

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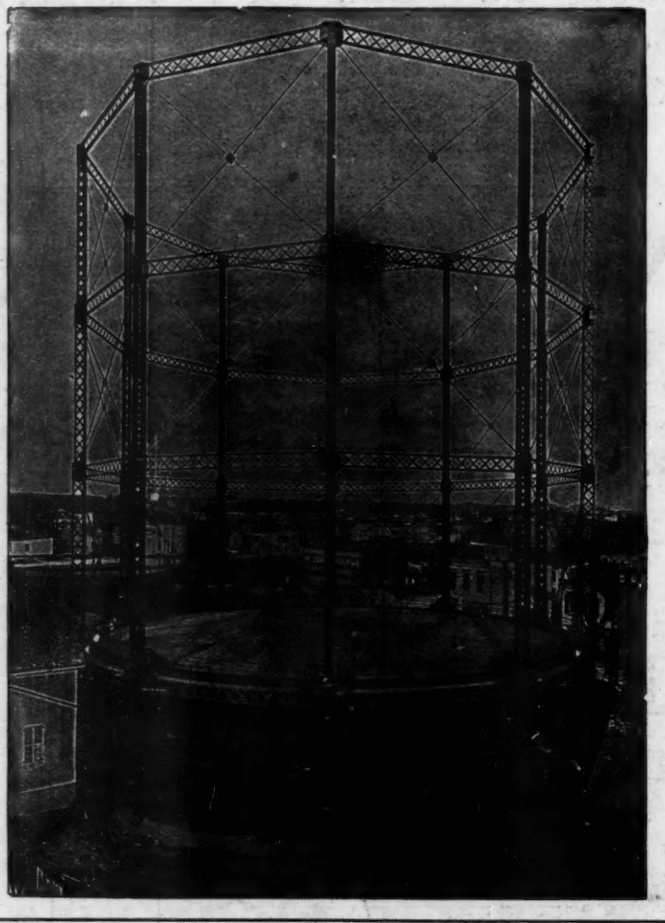

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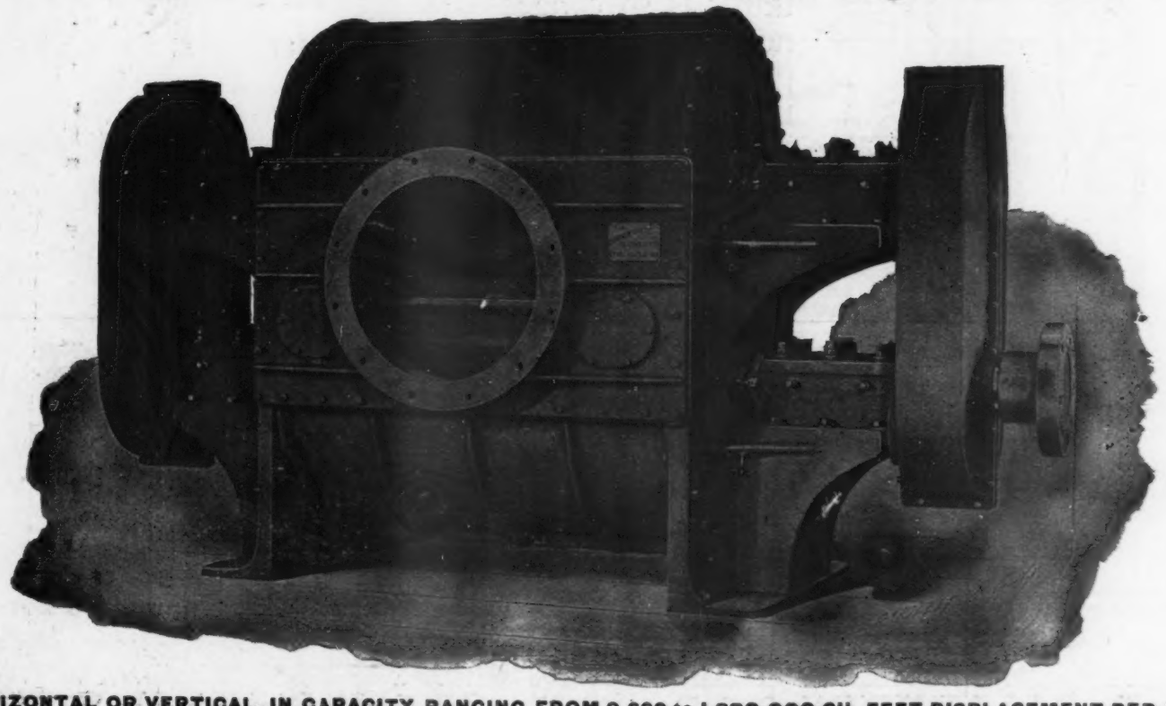

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